

SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Description of the Work
 - 2. Description of Milestones and Substantial Completion
 - 3. Location of the Site
 - 4. Work by Others
 - 5. Supplements

1.02 DESCRIPTION OF THE WORK

- A. The SELLER will initially furnish the High Rate Clarification (HRC) treatment train or trains requested by the BUYER for installation at the BUYER's Peak Excess Flow Treatment Facility (PEFTF) which will be constructed by others at the City of Salem River Road Park Phase 1. Besides furnishing the HRC equipment for this initial installation the SELLER will be required to provide the following services for Phase 1 installation:
 - 1. Special Services during BUYER's finalization of design.
 - 2. Special Services to BUYER and BUYER's Contractor.
 - 3. Special Services to BUYER for equipment checkout, startup and testing.
 - 4. Special services to BUYER for Operation and Maintenance training.
- B. The BUYER intends to expand, at some time in the future, the PEFTF facility beyond its first phase size. The SELLER's bid includes guaranteed price for future 20 MGD HRC treatment system(s), future 30 MGD HRC treatment system(s) and future 40 MGD HRC treatment system(s). The BUYER may elect to purchase one or more 20, 30, or 40 MGD HRC treatment systems at some future time(s) from SELLER or any other vendor. If the BUYER procures additional equipment from the SELLER, the purchase price would equal the bid price for the specific treatment system size escalated by the BUYER per cost index listed in Section 01200. Special Services similar to those required for the Phase 1 installation would be negotiated by BUYER and SELLER at the time the future PEFTF expansions occurred.

1.03 DESCRIPTION OF MILESTONES AND SUBSTANTIAL COMPLETION

- A. Information pertaining to the Contract Time and Liquidated Damages established for the Milestones is located in Article 5, Section 00500 - Form of Agreement Between BUYER and SELLER.
- B. Information pertaining to BUYER's right to withhold Liquidated Damages from progress payments is located in Article 5.05, Section 00500 - Form of Agreement Between BUYER and SELLER.
- C. The Contract Times for the Milestone(s) begin and accrue independently. Failure to meet a Milestone is not justification for relief from the Contract Time of other Milestone(s).
- D. Supplement 01110-A - Requirements to Complete the Project Milestone(s), provides a description of the minimum requirements to complete the Milestone(s).
- E. Defective or incomplete Goods/Special Services shall be completed prior to certification by PROJECT MANAGER of reaching the Milestone(s) and Substantial Completion.

1.04 LOCATION OF THE SITE

- A. The Site is located at River Road Park - 3045 River Road N., Salem, OR 97303.

1.05 WORK BY OTHERS

- A. BUYER, BUYER's Contractor, utilities, and others shall perform construction and various maintenance activities within the Project area while the Special Services are being performed. The activities known to BUYER at the time of the Bid and anticipated to impact Contract Time and Contract Price are as contained in Supplement 01110-B - Work By Others.
- B. Schedule the Special Services with BUYER, utilities, and others and cooperate to minimize mutual interference.
- C. Contract Price, Milestone(s), and Contract Time includes the coordination and cooperation related to these activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUPPLEMENTS

- A. Supplement 01110-A - Requirements to Complete the Project Milestone(s).
- B. Supplement 01110-B - Work By Others.

—END OF SECTION—

Supplement 01110-A
Requirements to Complete the Project Milestone(s)

The following are the minimum requirements to comply with the Project Milestones(s):

Milestone No.		Description	Completion Date
Phase 1			
1			
	A	Process Design Submittal (Draft) - Submittal of draft HRC Process design calculations, equipment sizing, basin hydraulic criteria and sizing, chemical usage, HRC equipment power requirements, and HRC control system architecture. (See selected HRC process Specification).	45 Days after award of contract
	B	Process Design Submittal (Final) - Incorporation of BUYER's comments to the Draft Process Design Submittal. (See selected HRC process Specification).	Per Article 5 of the Agreement
	C	Equipment Shop Drawing Submittal (Draft) - Submittal of draft HRC process equipment and control system shop drawings as identified in the detailed equipment specifications. (See selected HRC process Specification).	45 days after award of contract
	D	Equipment Shop Drawing Submittal (Final) - Incorporation of BUYER's comments to the Draft Equipment Submittal. (See selected HRC process Specification).	Per Article 5 of the Agreement
2		HRC System Delivery - Delivery of specified equipment, service equipment and special tools, control system hardware and all specified appurtenances. (See selected HRC process Specification).	Per Article 5 of the Agreement
3			

Milestone No.		Description	Completion Date
	A	O&M Manuals Submittal (Draft) - Submission of draft operations and maintenance manuals for all HRC equipment and control systems. (See Section 01785).	No less than 90 days prior to date of equipment delivery
	B	O&M Manuals Submittal (Final) - Incorporation of BUYER's comments to the Draft O&M Manuals Submittal. (See Section 01785)	With delivery of HRC System
4		Special Services - Completion of equipment checkout, startup and testing. (See Section 01750)	Prior to Substantial Completion
5		Special Services - Completion of the specified Operation and Maintenance training. (See Section 01820)	Prior to Substantial Completion
6			
	A	Punch List Verification - Completion and verification that BUYER's list of deficiencies has been corrected.	Prior to Substantial Completion
	B	Process Control Test Certification - Completion of on-site verification that BUYER's Contractor has completed mechanical and performance testing. (See Section 01750)	Prior to Substantial Completion
Additional Phases		Future Acquisitions	To be negotiated between BUYER and SELLER.

—END OF SUPPLEMENT—

Supplement 01110-B
Work By Others

The following work by others has been identified:

1. Site and excavation work.
2. Construction of the concrete process basins that make up the hydraulic structures of the HRC System will be completed by BUYER's Contractor.
3. Piping, equipment, valves, and other ancillary items not specified to support the HRC System will be provided and installed by BUYER's Contractor.
4. HRC System equipment installation, to include:
 - a. Setting of all process equipment.
 - b. Piping and connections between process equipment.
 - c. Conduit and wiring for connection of power and control to each piece of process equipment.
4. Power, water, chemicals, and other utilities required for the completion of the specified functional and operational testing will be provided by others.
5. Labor required to support the specified HRC system testing will be provided by BUYER's Contractor.
6. Laboratory testing to analyze water, sludge and other samples taken during the operational testing will be provided by the BUYER.

—END OF SUPPLEMENT—

SECTION 01111

FACILITY AND OPERATIONAL PLAN SUBMITTAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Generally
 - 2. Process Requirements
 - 3. Contents of Facility and Operational Plan Submittal
 - 4. Criteria and Cost Factors Used in Developing Facility and Operational Plan Cost Impact
 - 5. Supplement
- B. Related Sections
 - 1. Section 01112 - Performance Requirements.

1.02 GENERALLY

A. SELLER's shall make a separate Facility and Operational Plan Submittal as described herein and in the Section 00200 - Instructions to Bidders to provide information to allow for the development of a present worth cost. BUYER's Consultant will review this submittal and develop a present worth cost impact as described herein using their judgement and the criteria and cost factors contained in this section. This present worth cost will be added to Bidder's total Bid price.

1.03 PROCESS REQUIREMENTS

- A. See Section 01112 - Performance Requirements.

1.04 CONTENTS OF FACILITY AND OPERATIONAL PLAN SUBMITTAL

A. The Facility and Operational Plan submittal package will be reviewed by the BUYER's Consultant, who will determine if the proposed system is in compliance with the stated performance requirements, and perform the analysis described in 1.05. The submittal contents must be complete and provide all needed information to substantiate the performance requirements.

- B. The submittal package shall include, at a minimum, the following information:
1. A listing of the proposed equipment, including number of process trains, unit process sizes, and operating rates at the ultimate total design flow (160 mgd).
 2. A detailed startup, operation, and shutdown plan. The plan shall be referenced to the design storm hydrograph shown in Supplement 01111-A. Time zero shown on the design hydrograph shall correspond to the beginning of HRC operation. At time zero the capacity of the interceptor sewer to deliver raw wastewater to the downstream treatment facility is maximized, and wastewater pumped from the interceptor sewer through the HRC process must be discharged either to the Willamette River or to any necessary on-site storage facilities. Startup of HRC equipment prior to time zero shall not be allowed. The detailed plan shall include, but not be limited to, the following information:
 - a. Proposed wastewater pumping rates (up to 40 mgd maximum) during startup period.
 - b. Chemical feed strategy, including the potential startup and steady state rates.
 - c. Operating plan, including number of units staged into and out of service at various points in time.
 - d. Operating strategies used to determine when process changes are made (i.e., timers or process instrumentation, etc.).
 - e. Calculation of solids balances within process.
 - f. Amount of waste sludge discharged to sewer versus time, including flow and dry solids quantities.
 - g. Predicted effluent discharge quality versus time.
 - h. Amount of treated wastewater discharged to storage during startup, if applicable to meet the guaranteed performance and startup requirements per Section 01112.
 - i. A detailed description of shutdown and cleanup procedures, including methods of flushing tankage, equipment, and storage of residual ballast (if applicable).
 3. Provide a minimum of three references for full-scale, municipal combined sewer overflow or sanitary sewer overflow facilities at which the procedures defined in the Bidder's facility and operation plan have been used successfully. If Bidder's proposed startup and operation procedure includes storage of HRC effluent submit a minimum of three references for similar procedures. Provide the following for each reference:
 - a. Location of installation.
 - b. Reference name on contact information.
 - c. Date facility was placed into service.
 - d. Peak process capacity of the facility.
 - e. Required effluent quality and permitting limits in effect.

- f. Number and size of each process train(s) at the facility (must submit sizing information on 20, 30, and 40 mgd trains).

1.05 CRITERIA AND COST FACTORS USED IN DEVELOPING FACILITY AND OPERATIONAL PLAN COST IMPACT

Various criteria and cost factors will be used to evaluate the Bidder's (SELLER's) facility requirements and operational plan. These criteria and cost factors will be used by the BUYER's Consultant to develop a present worth cost for the facilities (HRC and required support facilities such as on-site storage or other improvements required to meet BUYER's Performance and Process requirements as described in this section) and operational plan. The present worth cost will not include BUYER's proposed pumping, fine screening or disinfection facilities. The criteria and cost factors will be applied by the BUYER's Consultant to the information supplied by the Bidder (SELLER) in their Facility and Operational Plan submittal. Where necessary, the BUYER's Consultant will apply their judgement and expertise in interpreting and applying Bidder's submitted information. The outcome of this process is the development, by the BUYER's Consultant, of a total present worth cost for each Bidder's facility and operational plan requirements. This total present worth cost will be added to the Bidder's total Bid Price.

- A. The following criteria will be used in performing the present worth analysis:
 1. Analysis term is 20 years.
 2. Annual discount rate over 20 years is six percent.
 3. Assumed timing for additional HRC treatment units (trains):
 - a. Two 20 MGD units on line and in service by wet weather season of 2006.
 - b. One additional 20 MGD and two 30 MGD units in service by wet weather season of 2010.
 - c. One 40 MGD units in service by wet weather season of 2015.
- B. The following cost factors will be used in performing the present worth analysis:
 1. Power cost (\$0.143/kWh)
 2. Staff cost (\$65/hour/operator)
 3. Cost of buried storage (\$2.00/gallon)
 4. Combined chemicals (\$160/MG treated)
 5. Sand ballast cost (\$200/ton for replacement of lost ballast)
 6. HRC plan area cost (\$300/ sq. ft.) includes superstructure building and land
 7. HRC basin costs (\$15/cu. ft. of HRC basins assuming 2.5 feet of free board above normal water surface).

PART 2 PRODUCTS - NOT USED

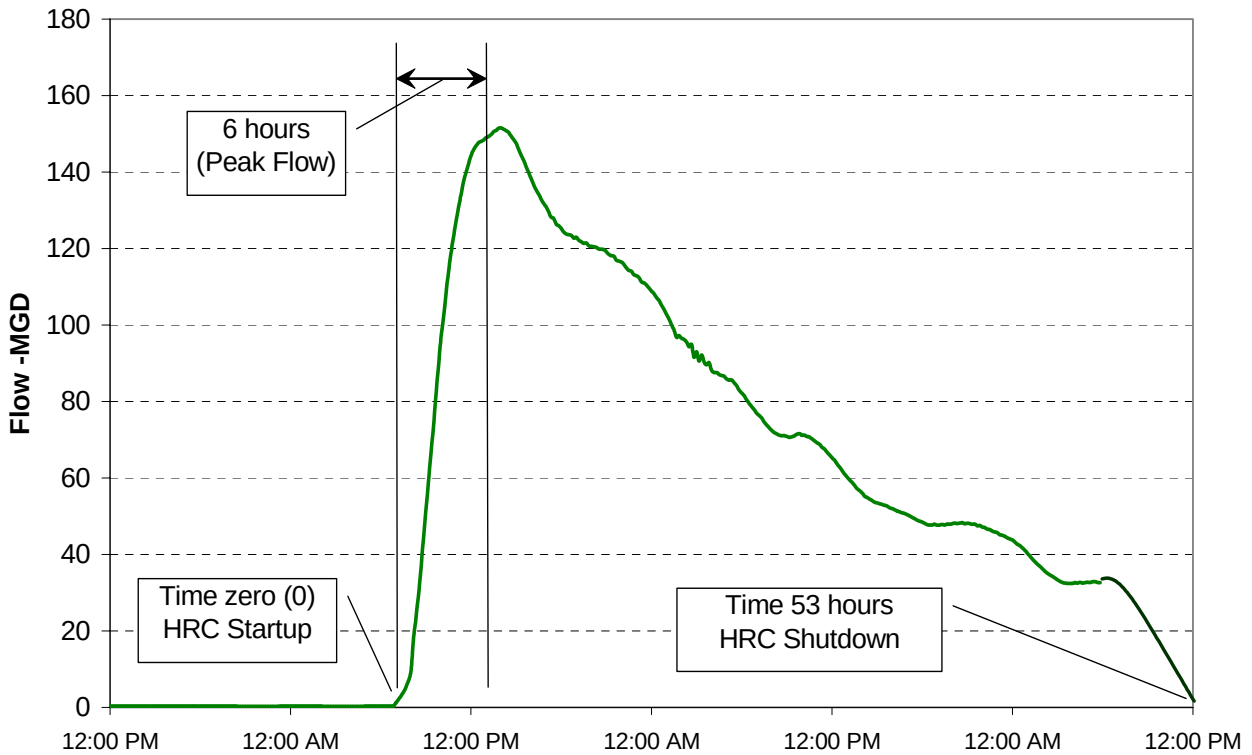
PART 3 EXECUTION

3.01 SUPPLEMENTS

Supplement 01111-A - Design Hydrograph.

—END OF SECTION—

Supplement 01111 - A
Design Hydrograph



PEFTF Projected Peak Design Hydrograph

—END OF SUPPLEMENT—

SECTION 01112

PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Generally
 - 2. Process Requirements

1.02 GENERALLY

- A. Systems considered in this Procurement shall comply with the requirements of this section. Complete conformance with other sections of this Procurement shall not relieve the SELLER from compliance with the HRC process requirements listed herein.

1.03 PROCESS REQUIREMENTS

The process requirements that the HRC System must meet are listed in the following table:

HRC Design Criteria / Operational Constraints	
Anticipated Influent Characteristics	
<u>Strength</u> BOD/TSS Soluble BOD Turbidity Alkalinity pH	40 to 100 mg/L 12 to 50 mg/L 20 to 140 NTU 40 to 80 mg/L 6.7 to 7.7
<u>Flow Range</u> ⁽¹⁾ Minimum Phase 1 Maximum Future Phases Ultimate Total	2 to 5 mgd (or as required to initiate startup) 2-20 mgd trains (40 mgd total) Possible combinations of 20 mgd, 30 mgd and 40 mgd trains 160 mgd

Preliminary Treatment (provided upstream of HRC process)	
Fine Screening Grit Removal	Approximately 6 mm screening for all flow. <u>Not</u> provided upstream of HRC process.
Guaranteed Performance Requirements After Startup Testing	
<u>Percent Removal</u> TSS Removal BOD Removal	85% (minimum) or 10 mg/L 50% (minimum) or 10 mg/L
Startup Requirements	
Startup Time Definition	The elapsed time between the moment that raw wastewater is first discharged from the outlet of the HRC process, and the moment that the quality of the discharged wastewater from the outlet of the HRC process begins to consistently meet guaranteed performance requirements.
Required Startup Time	No more than 30 minutes, unless storage is used for partially treated effluent. In all cases, the maximum allowable time that effluent from the PEFTF may be discharged into the Willamette River without meeting the guaranteed performance requirements shall be 30 minutes.
Chemical Requirements	
<u>Coagulant</u> Type Dose	Aluminum Chlorhydrate (ACH), or Polyaluminum Chloride (PAC) As needed to meet required startup time and performance.
<u>Polymer</u> Type Dose	As needed to meet required startup time and performance. As needed to meet required startup time and performance.
Siting/Layout Constraints	
<u>HRC Process Design</u> Layout Installation Operation	Modular units operating in parallel to achieve required capacity. Partially below ground (buried) concrete tankage. Seasonal intermittent operation, discharging treated effluent when conveyance capacity to the Willow Lake Treatment Plant is exceeded.
See Section 01111, Supplement 01111-A, Design Hydrograph. Actual wastewater flow into the remote treatment facility may be less than shown, for longer durations than shown, or at a more irregular pattern.	

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

—END OF SECTION—

SECTION 01200

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Measurement procedures.
 - 2. Item descriptions.
 - 3. Payment for Special Services.
 - 4. Incidental Services.
 - 5. Value Engineering Proposal.
 - 6. Contract Modification Procedures.
 - 7. Requirements of Application for Payment.
 - 8. Escalation for future purchases.
 - 9. Payment procedures.
 - 10. Supplements.

1.02 MEASUREMENT PROCEDURES

- A. Measurement for the purposes of payment to the SELLER will be based on the completion of deliverables as outlined within the Contract Documents.
- B. Deliverables shall include all items, including the Special Services as outlined in Supplement 01200-A - Bid Item Descriptions.
- C. Unless agreed otherwise in writing, units of measure shown on the Bid Form shall be as follows:

ITEM	METHOD OF MEASUREMENT
LS	Lump Sum - No count, payment based on Application for Payment and PART 1.10 G.
Allow	Allowance - Total amount fixed by BUYER. Measurement based on application by SELLER approved by BUYER.
Each	Each - Per unit supplied, complete.
HR	Hours - As measured by the cumulative amount of time worked, based on review of timecards by PROJECT MANAGER.

1.03 ITEM DESCRIPTIONS

- A. Supplement 01200-A - Bid Item Descriptions, provides a complete description of the items provided on the Bid Form.
- B. Payment for the Goods and Special Services included in a particular Bid item description will only be allowed as part of the specific Bid item.

1.04 PAYMENT FOR SPECIAL SERVICES

- A. Payment for Special Services (Bid Items 4a, 4b, 5a, 5b, 6a, 6b, 7a, and 7b,) will be based on SELLER's indicated staff hour rates for staff involved multiplied by actual time expended for the required Service.
- B. Services requested by the BUYER following final payment and non warranty items, will be paid for using the same rates and procedures as for Bid Item 7a and 7b.
- C. Reimbursable expenses (Bid Item 8) for travel, lodging, and meals will be based on actual cost. The maximum daily amount allowed for daily lodging and meals is \$135.00.
- D. Reimbursable air travel is authorized at coach fare with a minimum of two weeks advance notice.

1.05 INCIDENTAL SERVICES

- A. When services are required as part of the procurement, and no specific bid item is provided, the cost of these services shall be considered to be incidental to the HRC System and included in the Contract Price.

1.06 VALUE ENGINEERING PROPOSAL

- A. Value Engineering differs from a substitution pursuant to paragraph 5.04.C, Section 00700 - General Conditions.
- B. Use the form in Section 00640 - Value Engineering Change Proposal, to submit Value Engineering Change Proposals
- C. Submit form to PROJECT MANAGER pursuant to paragraph 5.04.C, of Section 00700 - General Conditions.

1.07 CONTRACT MODIFICATION PROCEDURES

- A. The Contract Price and Contract Time may be modified pursuant to paragraph 7.03, of Section 00700 - General Conditions.
- B. Work completed prior to the execution of a Buyer's Directive or Change Order is done at the risk of SELLER.
- C. SELLER shall not be paid for modified Goods and Special Services until a Change Order has been executed and processed by BUYER.

1.08 REQUIREMENTS OF APPLICATION FOR PAYMENT

- A. Submit an Application for Payment pursuant to paragraph 2.05 of the Section 00700 - General Conditions.

1.09 ESCALATION FOR BUYER'S FUTURE PURCHASES

- A. At the BUYER's discretion, future HRC System purchases may be made per Section 00500, Article 2.01 B. The price for these future purchases will equal the Lump Sum unit price indicated in the Bid Form escalated to the time of the future purchase based on use of Engineering News-Record (ENR) Construction Cost Index for Heavy Construction. This escalation index would be applied from date BUYER and SELLER execute the Agreement for the purchase of the first trains escalated ahead to the date of BUYER's future purchase. SELLER's special services requested by the BUYER, at the time of additional purchase(s), would be negotiated at the time of the such future purchase(s).

1.10 PAYMENT PROCEDURES

- A. Use the form in Section 00621 - Application for Payment.
- B. Submit applications for payment pursuant to paragraph 10.01, and paragraph 10.05 for final payment, Section 00700 - General Conditions.
- C. Application for Payment not meeting the requirements of paragraphs 10.01 and 10.05, Section 00700 - General Conditions, as applicable, shall be returned to SELLER without processing. SELLER shall not be due interest on monies as a result of Applications for Payment not meeting the applicable requirements.
- D. SELLER's payment shall be mailed to the address indicated on the Form of Agreement, unless PROJECT MANAGER is notified otherwise with the submittal of the Application for Payment.
- E. Refer to paragraphs 10.01.C, Section 00700 - General Conditions for information related to PROJECT MANAGERS's review of the Application for Payment.

- F. Refer to paragraphs 10.01.E, Section 00700 - General Conditions for information related to BUYERS's authority to reduce payment amount requested by SELLER.
- G. Payments by BUYER to SELLER for Awarded Bid Item(s) 1 and/or 2 and/or 3, excluding any retainage amount, shall be in compliance with the Milestone percentages listed in Article 7 of the Agreement.
- H. Special Services (Bid Form items 4a, 4b, 5a, 5b, 6a, 6b, 7a, and 7b) will be paid for by BUYER on a monthly basis based on an itemized invoice from the SELLER utilizing the appropriate hourly staff rates and reimbursable expenses (Bid Item 8).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUPPLEMENTS

- A. Supplement 01200-A - Bid Item Descriptions.

—END OF SECTION—

Supplement 01200-A
Bid Item Descriptions

Item No.	Item Name	Item Description
1	20 MGD HRC Treatment Systems	This item includes costs for fabrication and delivery to the site of the HRC System. Includes submittals per Supplement 01330-A.
2	30 MGD HRC Treatment System	This item includes costs for fabrication and delivery to the site of the HRC System. Includes submittals per Supplement 01330-A.
3	40 MGD HRC Treatment System	This item includes costs for fabrication and delivery to the site of the HRC System. Includes submittals per Supplement 01330-A.
4	SELLER's Special Services During BUYER's Finalization of Design	This item is provided to accommodate the SELLER working with the BUYER during the finalization of the design of the BUYER's PEFTF Facility as further defined in the selected HRC Process Specification.
5	SELLER's Special Services to BUYER and BUYER's Contractor	This item is provided to accommodate the SELLER working with the BUYER and the BUYER's Contractor during the installation of the SELLER's furnished equipment as further defined in the selected HRC Process Specification.
6	SELLER's Special Services to BUYER for Equipment Checkout, Startup and Testing	This item is provided to accommodate the SELLER working with the BUYER and the BUYER's Contractor during equipment checkout, startup and testing as further defined in the Specification - Sections 01750, 01775, and 01810.

Item No.	Item Name	Item Description
7	SELLER's Special Services to BUYER for Operations and Maintenance Training	This item is provided to accommodate the SELLER working with the BUYER to facilitate operations and maintenance training as further defined in the Specifications - Section 01785 and 01820.
8	Reimbursable Expenses	This allowance is for actual travel, meals, and lodging expenses of the SELLER incurred while providing the Special Services.
9	Alternative: Cost Adjustment if BUYER elects to use SELLER's furnished PLC's and in lieu of BUYER furnished Foxboro I/A.	This item covers the cost adjustment (+/-) for SELLER furnishing PLC's with programming for the SELLER's proprietary program in lieu of BUYER furnishing Foxboro I/A equipment in which the SELLER would install SELLER's proprietary program.

—END OF SUPPLEMENT—

SECTION 01300

SPECIAL SERVICES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Description of Special Services
 - 2. Submittals
 - 3. Quality Assurance
 - 4. System Start Up, Commissioning, and Buyer's Training
- B. Allowances
 - 1. Reimbursable Expenses - See Section 01200 - Price and Payment Procedures for description of the travel allowance.
- C. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures.

1.02 DESCRIPTION OF SPECIAL SERVICES

- A. SELLER's Special Services During BUYER's Finalization of Design
 - 1. SELLER's Designer and Senior Designer to provide process and design engineering Special Services as indicated below to support the BUYER's design of the facility as it relates to the HRC System and related subsystems.
 - 2. SELLER to provide engineering Special Services as required to size process equipment as required for the HRC System.
 - a. Equipment specifications for equipment supplied under these specifications.
 - b. Technical instructions for operation and start-up of the HRC System, including subsystems as specified herein.
 - c. Basin sizing and equipment location drawings
 - d. Equipment installation plans and instructions
 - e. Control system I/O lists and terminal connection points for equipment, instrument, and controls interfacing with the system controls.

- B. SELLER's Special Services to BUYER and BUYER's Contractor
1. SELLER's Field Technician and/or Senior Field Technician shall visit the Site to inspect, check, and provide equipment installation instruction.
 - a. Installation instruction - Attend coordination meetings with the BUYER's Contractor and PROJECT MANAGER to coordinate the installation of SELLER's HRC System.
 - b. SELLER's Field Technician and/or Senior Field Technician shall provide technical assistance to the BUYER's Contractor to instruct, guide, and provide technical guidance to BUYER's Contractor's during equipment installation. At no time will SELLER's Field Technician and/or Senior Field Technician directly supervise the BUYER's Contractor.
 - c. SELLER's Field Technician and/or Senior Field Technician shall be present when the equipment is installed and shall advise the BUYER's Contractor to correct any deficiencies noted.
 - d. The SELLER's Field Technician and/or Senior Field Technician shall provide the BUYER with a written certification the equipment is properly installed, adjusted and ready for use.
 2. SELLER's Field Technician and/or Senior Field Technician shall provide Special Services to BUYER and the BUYER's Contractor to adjust the equipment during installation and testing as specified in Section 01750 - Starting and Adjusting.
- C. SELLER's Special Services to BUYER for Equipment Checkout, Startup and Testing.
1. Special Services to BUYER for Equipment Checkout, Start-up and Testing - Coordinate equipment checkout, start-up and testing activities for the HRC System during initial system start-up, testing and commissioning with the BUYER.
 - 1) Equipment checkout, start-up and testing activities to be in accordance with the requirements of Section 01750 - Starting and Adjusting.
 - 2) Commissioning to be in accordance with the requirements of Section 01810 - Commissioning.
- D. SELLER's Special Services to BUYER for Operation and Maintenance Training
1. SELLER's Field Technician and/or Senior Field Technician, or a representative of the manufacturer approved by the PROJECT MANAGER, shall provide the Special Services in order to meet the requirements of 01820 - Demonstration and Training.

1.03 SUBMITTALS

- A. Quality Assurance/Control Submittals
1. Pursuant to Section 01750 - Starting and Adjusting

2. Qualification Statements - Resumes and references confirming the qualifying experience for the Designer, Senior Designer, Field Technician, and Senior Field Technician.

B. Closeout Submittals

1. Pursuant to Section 01775 - Closeout Submittals and Procedures.
2. Pursuant to Section 01810 - Commissioning

1.04 QUALITY ASSURANCE

A. Qualifications

1. Designer - An individual with at least three years of design experience on the specified process.
2. Field Technician - An individual with at least three years of starting, adjusting, and commissioning experience on the specified process.
3. Senior Designer - An individual with at least ten years of design experience on the specified process.
4. Senior Field Technician - An individual with at least ten years of starting, adjusting, and commissioning experience on the specified process.

B. Pre-Installation Meetings

1. SELLER's Senior Designer and/or Senior Field Technician shall meet with the BUYER and the BUYER's Contractor prior to the installation of the HRC System.

1.05 SYSTEM START UP, COMMISSIONING, AND BUYER'S TRAINING

- A. Pursuant to Section 01750 - Starting and Adjusting, Section 01810 - Commissioning, and Section 01820 - Demonstration and Training

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

—END OF SECTION—

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Definitions.
 - 2. Quality assurance submittal procedures.
 - 3. Quality assurance submittal requirements.
 - 4. PROJECT MANAGER's review of quality assurance submittals.
 - 5. Quality control submittal procedures.
 - 6. Quality control submittal requirements.
 - 7. PROJECT MANAGER's review of quality control submittals.
 - 8. Supplements.

1.02 DEFINITIONS

- A. Treatment Plant - Willow Lake Water Pollution Control Facility (WPCF), 5915 Windsor Island Road N., Salem, OR, 97303-6197.
- B. PEFTF at River Road Park - 3045 River Road N., Salem, OR, 97303.

1.03 QUALITY ASSURANCE SUBMITTAL PROCEDURES

- A. Deliver five copies of quality assurance submittals, and any resubmittal to PROJECT MANAGER, at WPCF, unless another address is mutually agreed upon.
- B. Provide quality assurance submittals for each item listed in the schedule located at the end of this section, referred to as Supplement 01330-A - Schedule of Quality Assurance Submittals, and pursuant to paragraph 5.06, Section 00700 - General Conditions.
- C. Deliver quality assurance submittals utilizing the transmittal form in Section 00436-1, and execute the certification as indicated. A transmittal shall be provided for each quality assurance submittal.
- D. Number each transmittal with the submittal number from Supplement 01330-A, followed by a capital letter. "A" for the first review, "B" for the second review, etc.

- E. Quality assurance submittals transmitted without the proper transmittal will be marked “AMEND AND RESUBMIT” and returned, without review, to SELLER. This shall constitute the initial review by PROJECT MANAGER.

1.04 QUALITY ASSURANCE SUBMITTAL REQUIREMENTS

- A. Submit quality assurance submittals in sufficient detail to show compliance with specified requirements.
- B. Check, verify, and revise quality assurance submittals as necessary to bring them into conformance with Contract Documents, previously accepted quality assurance submittals, and actual field conditions.
- C. Determine and verify quantities, dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.
- D. Submit quality assurance submittals to PROJECT MANAGER pursuant to this section after completion of checking, verification, and coordinating the related information.
- E. Submit manufacturer's instructions with quality assurance submittal whenever made available by manufacturer and when installation, erection, or application in accordance with manufacturer's instructions is required by the Specifications.
- F. Excise or cross out non-applicable information and clearly mark applicable information with citations to, and terminology consistent with, the Contract Documents, with respect to product data and manufacturer's instructions.
- G. Provide or furnish products and special services in accordance with accepted quality assurance submittals, unless in conflict with Contract Documents.
- H. Provide notice to PROJECT MANAGER prior to commencing the furnishing of products if, in the opinion of SELLER, the products indicated in a quality assurance submittal are in conflict with the Contract Documents.
- I. SELLER shall not proceed with tasks related to the ordering or fabrication of equipment if a quality assurance submittal for the material is required, and not yet accepted.

1.05 PROJECT MANAGER’S REVIEW OF QUALITY ASSURANCE SUBMITTAL

- A. Quality assurance submittals will be reviewed by PROJECT MANAGER, and returned within 30 days from the date received.

- B. The quality assurance submittals shall be noted as either “ACCEPTED,” “ACCEPTED AS NOTED,” or “AMEND AND RESUBMIT,” with appropriate comments if required.
- C. Documents required to be prepared by an engineer, architect, or landscape architect and provided in support of a quality assurance submittal shall carry the certification of the professional in responsible charge pursuant to the regulations of the State of Oregon.
- D. If PROJECT MANAGER is of the opinion a document requires a certification and SELLER provides it without one, the quality assurance submittal shall be returned as “AMEND AND RESUBMIT.”
- E. PROJECT MANAGER shall be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular quality assurance submittal.
- F. Costs incurred by BUYER as a result of additional reviews of a particular submittal beyond the initial review and a subsequent review shall be handled pursuant to paragraph 10.01, C.5.e., Section 00700 - General Conditions.

1.06 QUALITY CONTROL SUBMITTAL PROCEDURES

- A. Deliver five copies of quality control submittals, and any resubmittal to PROJECT MANAGER, at the Treatment Plant, unless another address is mutually agreed upon.
- B. Provide quality control submittals for each item listed in the schedule located at the end of this section, referred to as Supplement 01330-B - Schedule of Quality Control Submittals, and pursuant to paragraph 5.06, Section 00700 - General Conditions.
- C. Deliver quality control submittals utilizing the transmittal form in Section 00436-1 and execute the certification as indicated. A transmittal shall be provided for each quality control submittal.
- D. Number each transmittal with the submittal number from Supplement 01330-B, and the next consecutive capital letter applied to the item.
- E. Quality control submittals transmitted without the proper transmittal will be returned, without review, to SELLER.

1.07 QUALITY CONTROL SUBMITTAL REQUIREMENTS

- A. Provide testing services as outlined in the detailed equipment specifications. Testing to be performed and certified by the professional in responsible charge pursuant to the regulations of the State of Oregon.

1.08 PROJECT MANAGER'S REVIEW OF QUALITY CONTROL SUBMITTALS

- A. Provide quality control submittals within seven days following the quality control activity, or the time frame established in the specification calling for the quality control submittal, whichever is less. In all cases, they shall be provided pursuant to paragraph 1.07.A herein, and prior to commencing related furnishing of products.
- B. PROJECT MANAGER will review the quality control submittals within 15 days of receipt.
- C. If PROJECT MANAGER determines the results from the quality control submittal show the products to be in compliance with the Contract Documents, no further action will be taken.
- D. If PROJECT MANAGER has questions regarding the quality control submittal, or determines the results contained in the quality control submittal are not in compliance with the Contract Documents, PROJECT MANAGER will provide a written notice to SELLER.
- E. Respond promptly to address the questions raised by PROJECT MANAGER, or to rework the noncompliant products.
- F. Responsibility for costs to correct non-conforming goods or special services as a result of PROJECT MANAGERS's review of a quality control submittal shall be handled pursuant to paragraph 8.02, Section 00700 - General Conditions.
- G. PROJECT MANAGER shall be entitled to rely upon the accuracy or completeness of measurements, tests, calculations, or certifications made by licensed professionals accompanying a particular quality control submittal.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUPPLEMENTS

- A. Supplement 01330-A - Schedule of Quality Assurance Submittals.
- B. Supplement 01330-B - Schedule of Quality Control Submittals.

—END OF SECTION—

Supplement 01330-A
Schedule of Quality Assurance Submittals

Item No.	Item Description	Contract Document Location	Approval Deadline to
1	HRC System	Specification Section 11511, 11512, 11515, or specification issue per addenda.	Pursuant to Section 01200 Jan 15, 2004
2	Instrumentation	Specification Sections 11511, 11512, 11515, 13420, or specification issue per addenda.	Pursuant to Section 01200 Jan 15, 2004
3	Programmable Logic Controllers	Specification Section 13451	Pursuant to Section 01200 Jan 15, 2004
4	Miscellaneous Process Piping	Specification Section 15220	Pursuant to Section 01200 Jan 15, 2004
5	Miscellaneous Process Valves	Specification Section 15223	Pursuant to Section 01200 Jan 15, 2004
6	Eccentric Plug Valves	Specification Section 15224	Pursuant to Section 01200 Jan 15, 2004
7	Manual Valve Actuators	Specification Section 15236	Pursuant to Section 01200 Jan 15, 2004

—END OF SUPPLEMENT—

Supplement 01330-B
Schedule of Quality Control Submittals

Item No.	Item Description	Contract Document Location	Payment	Submittal Deadline to Receive Payment
1	Special Services to BUYER and BUYER's Contractor	Specification Section 11511 or 15112	Pursuant to Section 01200	Pursuant to Section 01200
2				
3				
4				
5				

—END OF SUPPLEMENT—

SECTION 01400

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Definitions.
 - 2. Regulatory requirements.
 - 3. Permits and inspections required by local building official.
 - 4. Quality assurance.
 - 5. Quality control.
 - 6. References.
 - 7. Supplements.

1.02 DEFINITIONS

- A. Treatment Plant - Willow Lake Water Pollution Control Facility (WPCF), 5915 Windsor Island Road N., Salem, OR, 97303-6197.
- B. PEFTF at River Road Park - 3045 River Road N., Salem, OR, 97303.

1.03 REGULATORY REQUIREMENTS

- A. SELLER's attention is directed to paragraph 7.02, Section 00700 - General Conditions regarding Laws and Regulations applicable to the Work.

1.04 QUALITY ASSURANCE

- A. Provide quality assurance submittals pursuant to Section 01330 - Submittal Procedures.
- B. Submit a request for interpretation before proceeding with the Work if a manufacture's instructions conflict with the Contract Documents.

1.05 QUALITY CONTROL

- A. Provide quality control submittals pursuant to Section 01330 - Submittal Procedures.

- B. Provide inspections and testing pursuant paragraph 8.01, Section 00700 - General Conditions.
- C. Submit copies of reports documenting the results of inspections and tests required to the PROJECT MANAGER no later than 14 calendar days following the inspection or test.
- D. Submit copies of final approval required by the governing jurisdiction to PROJECT MANAGER prior to Substantial Completion.
- E. Pressure test pipelines and appurtenances, and electrical, instrumentation, mechanical, and related equipment.
- F. Costs incurred by BUYER related to failed tests, or Work not ready to test will be deducted from SELLER's Application for Payment pursuant to paragraph 8.01 A.3., Section 00700 - General Conditions.

1.06 REFERENCES

- A. Contact information for the organizations responsible to prepare and maintain the standards referenced in the Contract Documents is provided in Supplement 01400-A - Reference Organizations.
- B. Obtain copies of documents issued by these organizations, if applicable.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUPPLEMENTS

- A. Supplement 01400-A - Reference Organizations.

—END OF SECTION—

Supplement 01400-A
Reference Organizations

Acronym	Name, Address, and Telephone Number
AA	Aluminum Association 900 19th St., NW Washington, DC 20006 www.aluminum.org (202) 862-5100
AABC	Associated Air Balance Council 1518 K St., NW Washington, DC 20005 www.aabchq.com (202) 737-0202
AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268 www.aamanet.org (847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., NW, Suite 249 Washington, DC 20001 www.aashto.org (202) 624-5800 (800) 231-3475
ABMA	American Bearing Manufacturers Association 1200 19th St., NW, Suite 300 Washington, DC 20036-2422 www.abma-dc.org (202) 429-5155

Acronym	Name, Address, and Telephone Number
ACGIH	American Conference of Governmental Industrial Hygienists 1330 Kemper Meadow Dr. Suite 600 Cincinnati, Ohio 45240 www.acgih.org (513) 742-2020
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333 www.aci-int.org (248) 848-3700
ADC	Air Diffusion Council 104 South Michigan Ave., Suite 1500 Chicago, IL 60603 (312) 201-0101
ADSC	The International Association of Foundation Drilling 9696 Skillman Street, Suite 280 Dallas, TX 75243 www.adsc-iafd.com (214) 681-5994
AF&PA	American Forest and Paper Association 1111 19th St., NW, Suite 800 Washington, DC 20036 www.afandpa.org (202) 463-2700
AGC	Associated General Contractors of America 1957 E Street N.W. Washington, DC 20006
AHA	American Hardboard Association 1210 W. Northwest Hwy Palatine, IL 60067 www.hardboard.org (847) 934-8800

Procurement of High Rate Clarification System 01400- A- 2
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
AI	Asphalt Institute Research Park Drive P.O. Box 14052 Lexington, KY 40512-4052 www.asphaltinstitute.org (606) 288-4960
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001 www.aisc.org (312) 670-2400
ISI	American Iron and Steel Institute 1101 17th St., NW, Suite 1300 Washington, DC 20036 www.steel.org (202) 452-7100 (800) 277-3850
AITC	American Institute of Timber Construction 7012 S. Revere Pkwy, Suite 140 Englewood, CO 80112 www.aitc-glulam.org (303) 792-9559
AMCA	Air Movement and Control Association International, Inc. 30 W. University Dr. Arlington Heights, IL 60004-1893 www.amca.org (847) 394-0150
ANSI	American National Standards Institute 1819 L. Street, N.W. Washington, DC 20036 www.ansi.org (202) 293-8020

Procurement of High Rate Clarification System 01400- A- 3
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
APA/EWA	APA-The Engineered Wood Association P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org (253) 565-6600
API	American Petroleum Institute 1220 L St., NW Washington, DC 20005-4070 www.api.org (202) 682-8000
AREMA	American Railway Engineering and Maintenance-of-Way Association 8201 Corporate Drive, Suite 1125 Landover, MD 02785-2230 www.arema.org (301) 459-3200
ARI	Air-Conditioning and Refrigeration Institute 4301 Fairfax Dr., Suite 425 Arlington, VA 22203 www.ari.org (703) 524-8800
ARRA	Asphalt Recycling and Reclaiming Association #3 Church Circle, PMB 250 Annapolis, MD 21401 www.arra.org (410) 267-0023
ASCE	American Society of Civil Engineers World Headquarters 1801 Alexander Graham Bell Dr. Reston, VA 20191-4400 www.asce.org (800) 548-2723 (703) 295-6300

Procurement of High Rate Clarification System 01400- A- 4
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329 www.ashrae.org (800) 527-4723 (404) 636-8400
ASME	American Society of Mechanical Engineers 3 Park Ave. New York, NY 10016-5990 www.asme.org (800) 843-2763
ASSE	American Society of Sanitary Engineering 901 Canterbury, Suite A Westlake, OH 44145 www.asse-plumbing.org (440) 835-3040
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 www.astm.org (601) 832-9585
AWI	Architectural Woodwork Institute 1952 Isaac Newton Sq. West Reston, VA 20190 www.awinet.org (703) 733-0600
AWPA	American Wood-Preservers' Association P.O. Box 5690 Granbury, TX 76049 www.awpa.com (817) 326-6300

Procurement of High Rate Clarification System 01400- A- 5
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
AWS	American Welding Society 550 NW LeJeune Rd. Miami, FL 33126 www.amweld.org (800) 443-9353 (305) 443-9353
AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235 www.awwa.org (303) 794-7711
CDA	Copper Development Association Inc. 260 Madison Ave., 16th Floor New York, NY 10016 www.copper.org (800) 232-3282 (212) 251-7200
CGA	Compressed Gas Association 1725 Jefferson Davis Hwy, Suite 1004 Arlington, VA 22202-4102 www.cganet.com (703) 412-0900
CISCA	Ceilings and Interior Systems Construction Association 1500 Lincoln Hwy, Suite 202 St. Charles, IL 60174 www.cisca.org (630) 584-1919
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Rd., Suite 419 Chattanooga, TN 37421 www.cispi.org (423) 892-0137

Procurement of High Rate Clarification System 01400- A- 6
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Suite 300 Columbia, MD 21046 www.chainlinkinfo.org (301) 596-2583
CRI	Carpet and Rug Institute 310 S. Holiday Ave. Dalton, GA 30722-2048 www.carpet-rug.com (800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Rd. Schaumburg, IL 60173-4758 www.crsi.org (847) 517-1200
CSSB	Cedar Shake and Shingle Bureau P.O. Box 1178 Sumas, WA 98295 www.cedarbureau.org (604) 462-8961
CTI	Cooling Technology Institute 530 Wells Fargo Drive, Suite 218 Houston, TX 77090 www.cti.org (281) 583-4087
DASMA	Door and Access Systems Manufacturers Association International 1300 Summer Avenue Cleveland, OH 44115-2851 www.dasma.com (216) 241-7333

Procurement of High Rate Clarification System 01400- A- 7
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
DHI	The Door and Hardware Institute 14150 Newbrook Dr., Suite 200 Chantilly, VA 20151 www.dhi.org (703) 222-2010
EIMA	EIFS Industry Members Association 3000 Corporate Center Dr., Suite 270 Morrow, GA 30260 www.eifsfacts.com (800) 294-3462 (770) 968-7945
EPA	Environmental Protection Agency US EPA/NSCEP P.O. Box 42419 Cincinnati, Ohio 45242 www.epa.gov (800) 490-9198
FAA	Federal Aviation Administration 800 Independence Ave., SW Washington, DC 20591 www.faa.gov (202) 366-4000
FM	FM Global Corporate Headquarters. P.O. Box 7500 Johnston, RI 02919 www.factorymutual.com (781) 762-4300

Acronym	Name, Address, and Telephone Number
FS	Federal Specification Unit General Services Admin. Federal Supply Service FSS Acquisition Management Center Environmental Programs and Engineering Policy Division Washington, DC 20406 http://pub.fss.gsa.gov (703) 305-5682
GA	Gypsum Association 810 First St., NE, Suite 510 Washington, DC 20002 www.usg.com www.gypsum.org (202) 289-5440
GANA	Glass Association of North America 2945 Southwest Wanamaker Dr., Suite A Topeka, KS 66614 www.glasswebsite.com/gana (785) 271-0208
HI	Hydronics Institute Division of Gas Appliance Manufacturers Association 2107 Wilson Blvd., Suite 600 Arlington, VA 22201 www.gamanet.org (703) 525-7060
HMMA	Hollow Metal Manufacturers Association Division of NAAMM 8 South Michigan Ave., Suite 1000 Chicago, IL 60603 www.naamm.org (312) 332-0405

Acronym	Name, Address, and Telephone Number
HPVA	Hardwood Plywood and Veneer Association P.O. Box 2789 Reston, VA 20195-0789 www.hpva.org (703) 435-2900
IAS	International Approval Services U.S. Operations 8501 E. Pleasant Valley Rd. Cleveland, Ohio 44131-5575 www.approvals.org (216) 524-4990
ICC	International Code Council 5203 Leesburg Pike #708 Falls Church, VA 22041 www.intlcode.org (703) 931-4533
IEEE	Institute of Electrical and Electronics Engineers 3 Park Ave., 17th Floor New York, NY 10016-5997 www.ieee.org (212) 419-7900
IES	Illuminating Engineering Society of North America 120 Wall Street, 17 th Floor New York, NY 10005 www.iesna.org (212) 248-5000
ILI	Indiana Limestone Institute of America 400 Stone City Bank Building Bedford, IN 47421 www.iliai.com (812) 275-4426

Acronym	Name, Address, and Telephone Number
KCMA	Kitchen Cabinet Manufacturers Association 1899 Preston White Dr. Reston, VA 20191-5435 www.kcma.org (703) 264-1690
LPI	Lightning Protection Institute 3335 N. Arlington Heights Rd., Suite E Arlington Heights, IL 60004 www.lightning.org (800) 488-6864 (847) 577-7200
MBMA	Metal Building Manufacturers Association 1300 Sumner Ave. Cleveland, OH 44115-2851 www.mbma.com (216) 241-7333
MFMA	Maple Flooring Manufacturers Association 60 Revere Dr., Suite 500 Northbrook, IL 60062 www.maplefloor.org (847) 480-9138
MIA	Marble Institute of America 30 Eden Alley, Suite 301 Columbus, OH 43215 www.marble-institute.com (614) 228-6194
MIL	Military Standardization Documents Defense Automated Printing Service 700 Robbins Ave., Building 4D Philadelphia, PA 19111-5094 www.dodssp.daps.mil (215) 697-2179

Procurement of High Rate Clarification System 01400- A- 11
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180-4602 www.mss-hq.com (703) 281-6613
NAA	National Arborist Association Route 101, P.O. Box 1094 Amherst, NH 03031-1094 www.natlarb.com (800) 733-2622 (603) 673-3311
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Ave., Suite 1000 Chicago, IL 60603 www.naamm.org (312) 332-0405
NAAMM	North American Association of Mirror Manufacturers (Division of GANA) 2945 Southwest Wanamaker Dr., Suite A Topeka, KS 66614 www.glasswebsite.com (913) 266-7013
NACE	NACE International 1440 South Creek Drive Houston, TX 77084 www.nace.org (281) 228-6200
NAIMA	North American Insulation Manufacturers Association 44 Canal Center Plaza, Suite 310 Alexandria, VA 22314 www.naima.org (703) 684-0084

Acronym	Name, Address, and Telephone Number
NBGQA	National Building Granite Quarries Association, Inc. 1220 L. St., NW, Suite 100-167 Washington, DC 20005 www.nbgqa.com (800) 557-2848
NCMA	National Concrete Masonry Association 2302 Horse Pen Rd. Herndon, VA 20171-3499 www.ncma.org (703) 713-1900
NCRP	National Council on Radiation Protection and Measurement 7910 Woodmont Ave., Suite 800 Bethesda, MD 20814-3095 www.ncrp.com (301) 657-2652
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877 www.nebb.org (301) 977-3698
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814 www.necanet.org (301) 657-3110
NELMA	Northeastern Lumber Manufacturers Association 272 Tuttle Rd. P.O. Box 87A Cumberland Center, ME 04021 www.nelma.org (207) 829-6901

Procurement of High Rate Clarification System 01400- A- 13
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
NEMA	National Electrical Manufacturers Association 1300 N 17th St., Suite 1847 Rosslyn, VA 22209 www.nema.org (703) 841-3200
NETA	International Electrical Testing Association P.O. Box 687 106 Stone St. Morrison, CO 80465 www.netaworld.org (303) 697-8441
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101 www.nfpa.org (800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council 1300 Spring St., Suite 500 Silver Spring, MD 20910 www.nfrc.org (301) 589-6372
NIBS	National Institute of Building Sciences 1090 Vermont Ave., NW, Suite 700 Washington, DC 20005-4905 www.nibs.org (202) 289-7800
NIST	National Institute of Standards and Technology 100 Bureau Dr., MS 2150 Gaithersburg, MD 20899-2150 www.nist.gov (301) 975-4025

Acronym	Name, Address, and Telephone Number
NLA	National Lime Association 200 North Glebe Rd., Suite 800 Arlington, VA 22203 www.lime.org (703) 243-5463
NLGA	National Lumber Grades Authority #406-First Capital Pl. 960 Quayside Dr. New Westminster, BC V3M 6G2 CANADA www.nlga.org (604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association P.O. Box 3009 Memphis, TN 38173-0009 www.nofma.org (901) 526-5016
NPCA	National Paint and Coatings Association 1500 Rhode Island Ave., NW Washington, DC 20005 www.paint.org (202) 462-6272
NRCA	National Roofing Contractors Association O'Hare International Center 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018 www.roofonline.org (847) 299-9070
NSF	NSF International P.O. Box 130140 Ann Arbor, MI 48113-0140 www.nsf.org (734) 769-8010 (800) 673-6275

Procurement of High Rate Clarification System 01400- A- 15
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
NSPI	National Spa and Pool Institute 2111 Eisenhower Ave. Alexandria, VA 22314 www.nspi.org (703) 838-0083
NTMA	National Terrazzo and Mosaic Association 110 E. Market St., Suite 200-A Leesburg, VA 20176 www.ntma.com (800) 323-9736 (703) 779-1022
NUCA	National Utility Contractors Association 4301 North Fairfax Dr., Suite 360 Arlington, VA 22203-1627 www.nuca.com (703) 358-9300
PCA	Portland Cement Association 5420 Old Orchard Rd. Skokie, IL 60077 www.portcement.org (847) 966-6200
PCI	Precast/Prestressed Concrete Institute 209 W. Jackson Blvd. Chicago, IL 60606-6938 www.pci.org (312) 786-0300
PDCA	Painting and Decorating Contractors of America 3913 Old Lee Hwy, Suite 33-B Fairfax, VA 22030 www.pdca.com (703) 359-0826

Procurement of High Rate Clarification System 01400- A- 16
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
PDI	Plumbing and Drainage Institute 45 Bristol Dr. South Easton, MA 02375 http://PDIonline.org (800) 589-8956
PTI	Post Tensioning Institute 1717 W. Northern Ave., Suite 114 Phoenix, AZ 85021 www.post-tensioning.org (602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org
RIS	The Redwood Inspection Service 630 J Street Eureka, CA 95501 (707) 444-3024
SCMA	Southern Cypress Manufacturers Association 400 Penn Center Blvd., #530 Pittsburgh, PA 15235 www.cypressinfo.org (877) 607-7262
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021 www.sdi.org (847) 462-1930
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145-1967 www.steeldoor.org (440) 899-0010

Procurement of High Rate Clarification System 01400- A- 17
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Ave. Chicago, IL 60611 www.sigmaonline.org/sigma (312) 644-6610
SJI	Steel Joist Institute 3127 10th Ave., North Ext. Myrtle Beach, SC 29577-6760 www.steeljoist.org (843) 626-1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Dr. Chantilly, VA 20151-1209 www.smacna.org (703) 803-2980
SPIB	Southern Pine Inspection Bureau 4709 Scenic Hwy Pensacola, FL 32504-9094 www.spib.org (850) 434-2611
SPRI	Single Ply Roofing Institute 200 Reservoir St., 309 A Needham, MA 02494 www.spri.org (781) 444-0242
SSPC	SSPC: The Society for Protective Coatings 40 24th St., 6th Floor Pittsburgh, PA 15222-4656 www.sspc.org (800) 837-8303 (412) 281-2331

Procurement of High Rate Clarification System 01400- A- 18
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
STI	Steel Tank Institute 570 Oakwood Rd. Lake Zurich, IL 60047 www.steeltank.com (847) 438-8265
SWI	Steel Window Institute 1300 Sumner Ave. Cleveland, OH 44115-2851 www.steelwindows.com (216) 241-7333
SWRI	Sealant, Waterproofing and Restoration Institute 2841 Main St. Kansas City, MO 64108 www.swrionline.org (816) 472-7974
TCA	Tile Council of America, Inc. 100 Clemson Research Blvd. Anderson, S.C. 29625 www.tileusa.com (864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance 2500 Wilson Blvd., Suite 300 Arlington, VA 22201 www.tiaonline.org (703) 907-7700
TMS	The Masonry Society 3970 Broadway, Suite 201-D Boulder, CO 80304-1135 www.masonrysociety.org (303) 939-9700

Procurement of High Rate Clarification System 01400- A- 19
for Peak Excess Flow Treatment Facility /
Project No. 702056 /November 10, 2003

Quality Requirements

Acronym	Name, Address, and Telephone Number
TPI	Truss Plate Institute 583 D'Onofrio Dr., Suite 200 Madison, WI 53719 (608) 833-5900
TPI	Turfgrass Producers International 1855-A Hicks Rd. Rolling Meadows, IL 60008 www.turfgrassod.org (800) 405-8873 (847) 705-9898
UL	Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, IL 60062-2096 www.ul.com (847) 272-8800
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281 www.wclib.org (503) 639-0651
WDMA	Window and Door Manufacturers Association 1400 E. Touhy Ave., Suite 470 Des Plaines, IL 60018 www.nwwda.org (800) 223-2301
WH	Intertek Testing Services Warnock Hersey Listing Services 3210 American Drive Mississauga, Ontario Canada L4V 1B3 www.itsqs.com (905) 678-7820

Acronym	Name, Address, and Telephone Number
WIC	Woodwork Institute of California 3164 Industrial Blvd. West Sacramento, CA 95691 www.wicnet.org (916) 372-9943
WWPA	Western Wood Products Association 522 SW 5th Ave., Suite 500 Portland, OR 97204-2122 www.wwpa.org (503) 224-3930

—END OF SUPPLEMENT—

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Basic product requirements.
 - 2. Design Requirements.
 - 3. Specified products and substitutions.
 - 4. Delivery, storage, and handling requirements.
 - 5. BUYER-furnished products.
 - 6. Contracts assigned by BUYER.

1.02 BASIC PRODUCTS REQUIREMENTS

- A. Provide new Goods, unless specified otherwise in the Contract Documents.
- B. Goods will be considered by BUYER as an "approved equal" if approved pursuant to the requirements of paragraph 5.04 of the General Conditions.

1.03 DESIGN REQUIREMENTS

- A. Goods shall meet the requirements of the codes in effect in the State of Oregon at the time of the bid.
- B. Goods shall be designed utilizing seismic zone 4 and importance factor 1.5.

1.04 SPECIFIED PRODUCTS AND SUBSTITUTIONS

- A. In the event SELLER desires to substitute any part of the Goods with an "approved equal" item, the procedure in paragraph 5.04, Section 00700 - General Conditions must be followed.

1.05 DELIVERY, STORAGE, AND HANDLING REQUIREMENTS

- A. Deliver Goods pursuant to the current progress schedule and coordinated to avoid conflict with the other portions of the Project and conditions at the Site.

- B. Direct deliveries to the staging area. Deliveries shall not be accepted or conducted at any other location without the written approval of PROJECT MANAGER.
- C. BUYER's staff will not provide assistance in directing the delivery or unloading the Goods.
- D. Unloading will be performed by general construction contractor who will be responsible for off-loading the Goods at the work site.
- E. SELLER to provide all necessary instructions for lifting, storing, and setting equipment. Instructions shall provide, as a minimum, the following:
 - 1. Procedures for handling Goods by methods to prevent bending or overstressing.
 - 2. Drawings and data showing lift points and the anticipated loads.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

—END OF SECTION—

SECTION 01750

STARTING AND ADJUSTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Definitions.
 - 2. Sequence of start-up activities.
 - 3. General Requirements.
 - 4. SELLER's representative responsibilities.
 - 5. SELLER's start-up and verification of operation.
 - 6. SELLER's demonstration of operation to PROJECT MANAGER.
 - 7. SELLER's demonstration and assistance during software start-up activities.
 - 8. Record keeping.
 - 9. Supplements.

1.02 DEFINITIONS

- A. Manufacturer's Representative - Authorized service division employee of the HRC supplier. Shall be a Senior Field Technician or Field Technician as defined by these Specifications.

1.03 SEQUENCE OF START-UP ACTIVITIES

- A. Develop a specific plan for the testing and start-up activities required for the project and submit plan to PROJECT MANAGER for approval at least 21 days before the initial start-up of equipment begins. The plan shall, as a minimum, incorporate the activities itemized below.
 - 1. SELLER's representative shall certify installation meets manufacturer's recommendations.
 - 2. Calibrate instruments.
 - 3. SELLER's representative shall certify equipment operates as specified and as shown in the Contract Documents.
 - 4. SELLER's certification of start-up, testing, and verification of operation.
 - 5. SELLER's demonstration of operation to PROJECT MANAGER. Operation and maintenance manuals must be available during this activity.
 - 6. SELLER's demonstration and assistance during software start-up activities.
 - 7. Submit records kept during start-up and adjusting activities.
 - 8. Commissioning activities described in Section 01810 - Commissioning.

9. Demonstration and training activities described in Section 01820 - Operations and Maintenance Demonstration and Training.

1.04 GENERAL REQUIREMENTS

- A. Demonstrate proper function of all equipment, systems, and control devices.
- B. Provide BUYER's Contractor with tools, equipment, instruments, and Special Services required for, and incidental to, completing start-up and adjusting activities as specified herein.
- C. Provide Special Services for assembly, installation and testing guidance, and trouble shooting during start-up and adjusting activities.
- D. Complete Supplement 01750-A - Process Control Test Certification, and submit it to PROJECT MANAGER. The completion of this form is required prior to commencing with SELLER's demonstration of operation to PROJECT MANAGER.
- E. The BUYER's Contractor will be responsible for completing the following prior to, or during, the starting and adjusting of the mechanical systems:
 1. Remove rust preventatives and oils applied to protect equipment during construction.
 2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.
 3. Install and adjust packing, mechanical seals, o-rings, and other seals. Replace defective seals.
 4. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.
 5. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
 6. Perform cold alignment and hot alignment to manufacturer's tolerances.
 7. Adjust belt tension and variable pitch sheaves.
 8. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to insure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.
 9. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.
 10. Install gratings, safety chains, handrails, shaft guards, and sidewalks prior to operational testing.

The SELLER will be responsible for coordination with the BUYER's Contractor to ensure proper procedures are followed for all equipment provided under these specifications.

- F. Complete the following Special Services prior to, or during, the starting and adjusting of the electrical systems:
1. Perform insulation resistance tests on all wiring operating at or above 200 volts.
 2. Perform continuity tests on electrical conductor systems.
 3. Test and set circuit breaker relays for proper operation.
 4. Check motors for actual full load amperage draw. Compare to nameplate value.

The SELLER will be responsible for coordination with the BUYER's Contractor to ensure proper procedures are followed for all equipment provided under these specifications.

- G. Complete the following Special Services prior to starting and adjusting of the instrumentation systems:
1. Field calibrate instruments and make required adjustments and control point settings.
 2. Leak test pneumatic controls and instrument air piping.
 3. Energize transmitting and control signal systems, verify proper operation, ranges and settings.

The SELLER will be responsible for coordination with the BUYER's Contractor to ensure proper procedures are followed for all equipment provided under these specifications.

1.05 SELLER'S REPRESENTATIVE RESPONSIBILITIES

- A. SELLER's representative shall inspect the installation and certify with a written report, the installation meets the requirements of the Contract Documents as well as the equipment manufacturer's recommendations. This shall be done before the equipment is energized.
- B. At completion of the Special Services for start-up and testing activities, they shall each furnish a written report prepared and signed by the applicable Seller's representative, certifying the equipment:
1. Has been properly installed to meet seismic zone 4 requirements and has been adjusted, aligned, and lubricated as required.
 2. Is free of any stresses imposed by connecting piping or anchor bolts.
 3. Is suitable for satisfactory full-time operation under full load conditions.
 4. Operates within the allowable limits for vibration.
 5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.
 6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning.

1.06 START-UP AND VERIFICATION OF OPERATION

- A. Verify the equipment provided is installed correctly and functions properly.
- B. Complete Supplement 01750-A pursuant to the following:
 - 1. The schedule is not intended as a replacement for a systematic check of all the requirements specified.
 - 2. Fill out the schedule in full and sign it certifying they have successfully performed all the tests listed.
 - 3. Where it is not possible to test a function without the control software furnished, SELLER shall verify the inputs/outputs (I/O's) are terminated correctly by simulating the process as closely as possible and checking the I/O terminations for voltage or continuity.
- C. Submittal to, and approval by, PROJECT MANAGER of Supplement 01750-A, is a prerequisite to SELLER'S demonstration of operation to PROJECT MANAGER.
- D. Coordination:
 - 1. A Senior Field Technician or Field Technician who is familiar with operation of the equipment supplied and who has previous satisfactory experience in conducting tests of the type specified shall advise the BUYER's Contractor how to operate the equipment, perform all startup adjustments, and testing of system equipment, shall advise the BUYER's Contractor how to conduct each test, analyze the data, and certify the system's performance during mechanical startup testing, and optimization and process performance testing.
 - 2. The BUYER's Contractor will be responsible for ensuring that all related equipment, required for the operation of the SELLER's equipment, is fully operational prior to the initiation of testing activities. This equipment shall include, but not be limited to:
 - a. Influent pump station
 - b. Influent screening equipment
 - c. Influent flow metering
 - d. Control systems
 - e. Odor control system
 - f. UV disinfection system
 - g. Electrical power feed systems
 - 3. BUYER'S Contractor shall be responsible for scheduling testing activities, as approved by the PROJECT MANAGER. SELLER shall coordinate directly with the BUYER's Contractor all required activities by the SELLER.

E. Testing Schedule and Written Procedures

1. Not less than 60 days prior to mechanical startup testing, the SELLER, in coordination with the BUYER's Contractor, shall prepare and submit to the PROJECT MANAGER a testing schedule and detailed written procedures for mechanical startup testing, and optimization and performance testing. Issue submittal in accordance with the requirements of 01330 - Submittal Procedures. Submittal to include, but not be limited to the following:
 - a. Testing procedure
 - b. Forms for collecting data
 - c. Calculation formulas
 - d. Description of sample collections
 - e. Description of any analyses required

F. General Requirements for Testing

1. The following requirements shall apply to all testing activities as specified herein.
 - a. The BUYER's Contractor will be responsible for working with the BUYER to obtain the necessary flow to the facility to perform the specified testing.
 - b. Initial analyses of samples for mechanical startup testing and process performance testing that are designated to be performed by an independent testing laboratory shall be tested at a laboratory acceptable to the PROJECT MANAGER. All costs associated with the testing laboratory's work shall be included in the SELLER's Bid.
 - c. PROJECT MANAGER'S initial observation of tests will be at the BUYER's expense. If retesting is required due to failure of the initial tests or the inability to conduct the initial tests due to items which are included in the SELLER's scope of supply or services, the SELLER shall reimburse the BUYER in accordance with the General Conditions.
 - d. Analyses of samples for mechanical startup testing and optimization and performance testing that are not designated to be performed by an independent testing laboratory shall be at the expense of the SELLER. This would include, but not be limited to, analyses of influent flows to the SELLER's equipment in order to verify the total suspended solids are within the specified range, and to verify that the SELLER's equipment is performing satisfactorily.

G. Mechanical Startup Testing

1. After the SELLER has certified that the SELLER's equipment is completely installed in accordance with the SELLER's requirements and the requirements of the specification requirements.
2. The SELLER's representative shall verify the following mechanical startup tests:
 - a. Verify operating sequences, normal startup, normal shutdown, and emergency stop programming.
 - b. Submit each piece of equipment to complete start and stop cycles.

- c. Operate each HRC train with only one residuals pump operating for a minimum of two continuous hours. Repeat this test until all residuals pumps have been run for a minimum of two hours.
 - d. Operate each HRC train with all required equipment operating for a minimum of six continuous hours.
- 3. The SELLER's representative shall sample, check, and record the following during the testing:
 - a. Residuals (microsand/residuals for the Actiflo® system) recirculation pump flow and discharge pressure for each pump every hour that they are operated.
 - b. Residuals wasting pump (DensaDeg® only) flow and discharge pressure for each pump operating for each hour operated.
 - c. Chemical feed rates (Coagulant and Polymer) every hour.
 - d. Check HRC System instrumentation and control systems for conformance with the specifications.
 - e. Read and record all HRC system instrumentation every hour during testing.
 - f. Polymer injection points shall be recorded.
 - g. All other information that the SELLER, PROJECT MANAGER, or BUYER's Contractor deems necessary shall be obtained, checked and recorded.
 - h. The following additional items shall be obtained, checked, and recorded for the Actiflo® system.
 - 1) Hydrocyclone underflow samples from each operating system, every hour that the microsand/residuals pumps are run. These samples shall be analyzed by an independent testing laboratory acceptable to the PROJECT MANAGER for microsand content.
 - 2) At the completion of each run of the hydrocyclone(s), the solids collected in each sandloss detection box shall be emptied into a separate container. Each collection shall be dried and weighed by an independent testing laboratory acceptable to the PROJECT MANAGER. Each weight shall be used to determine the mg/L of microsand content in the hydrocyclone overflow.
- 4. The BUYER's Contractor will be responsible for collecting, sampling, checking, and recording the following during testing:
 - a. Influent flow rates for each HRC train. Readings shall be taken no less frequent than every 20 minutes.
 - b. Instrumentation and control systems for all support equipment.

H. Optimization and Process Performance Testing

- 1. After satisfactory completion of the mechanical startup testing, field optimization and process performance testing shall be performed.
- 2. Optimization testing shall be performed to adjust the HRC equipment for optimum performance.
- 3. Performance testing shall be performed to demonstrate that the HRC system meets the specified performance requirements.

4. The SELLER shall coordinate directly with the BUYER's Contractor for operation of the subsystems required to complete the Optimization Testing. The SELLER shall complete the Optimization testing within a four day period.
5. The BUYER's Contractor will coordinate with the BUYER to obtain the necessary process flows to complete the testing.
6. Process Performance Testing
 - a. During process performance testing the BUYER's Contractor will maintain a total flow rate of 20 mgd through either HRC train. All flow to the HRC trains will be screened by the fine screens, installed under a separate contract.
 - b. Each HRC system process performance test shall be run on a separate day.
 - c. Adjustments to the HRC System equipment will be allowed hourly during each test.
 - d. Each HRC train shall be subjected to a six hour test run, with each test being conducted on a separate day.
 - e. The SELLER's representative shall sample, check, and record the following during each test:
 - 1) Residual recirculation pump flow and discharge pressure each hour.
 - 2) At the start and end of testing and once every hour, instrument readings for all HRC equipment.
 - 3) Record polymer injection points.
 - 4) Influent flow rate to the HRC chamber being tested, recorded once every hour
 - 5) Chemical (Coagulant and Polymer) feed rates, every hour
 - 6) All other information that the SELLER, PROJECT MANAGER, or BUYER's Contractor deems necessary shall be obtained, checked and recorded.
 - 7) The following items are specific to the Actiflo® system:
 - a) Hydrocyclone underflow samples shall be obtained every hour and shall be analyzed by an independent laboratory.
 - b) The sandloss detection boxes shall operate at a flow rate as set by the SELLER's representative and as acceptable to the PROJECT MANAGER during each test. At the completion of each run of the hydrocyclone(s), the solids collected in each sandloss detection box shall be emptied into a separate container. Each collection shall be dried and weighed by an independent testing laboratory acceptable to the PROJECT MANAGER. Each weight shall be used to determine the mg/L of microsand content in the hydrocyclone overflow.
 - 8) The SELLER shall collect samples of the following which shall be analyzed by an independent testing laboratory acceptable to the PROJECT MANAGER:
 - a) Grab Samples of:
 - (1) The influent to the HRC system just downstream of the flow meters every hour that the test is conducted.

- (2) The effluent from the HRC system collected from water at the top of the on line settling chamber every hour that the test is conducted
- b) Each sample shall be tested for the following:
 - (1) Total Suspended Solids (TSS)
 - (2) Biochemical Oxygen Demand (BOD₅)
 - (3) Soluble BOD₅
 - (4) Carbonaceous Biochemical Oxygen Demand (CBOD₅)
 - (5) Chemical Oxygen Demand (COD)
 - (6) Soluble COD
 - (7) Fecal Coliform Count
 - (8) Turbidity
 - (9) Water Temperature (degrees C)
 - (10) Water pH
 - (11) Iron

1.07 SELLER'S DEMONSTRATION OF OPERATION TO PROJECT MANAGER

- A. The intent of the demonstration of the operation to PROJECT MANAGER is to ascertain the installation, including the hardwired control, are in compliance with the Contract Documents. This step will facilitate demonstration of the complete operations of the facilities when the control software is tested.
- B. Demonstrate compliance with the items indicated in Supplement 01750-A.
- C. PROJECT MANAGER may require the SELLER to demonstrate other functions or processes not listed in Supplement 01750-A.
- D. PROJECT MANAGER's approval of the demonstration of operation is required before the demonstration and testing of the control software shall commence.

1.08 SELLER'S DEMONSTRATION AND ASSISTANCE DURING SOFTWARE START-UP ACTIVITIES

- A. The intent of the demonstration of the operation with control software to PROJECT MANAGER is to ascertain the installation including the control software are in compliance with the Contract Documents.
- B. Demonstrate items listed in Supplement 01750-A, to PROJECT MANAGER. SELLER's role for this demonstration will largely entail simulation of alarm conditions, and the verification of correct I/O's received at the programmable logic controller and/or distributed control system.

- C. PROJECT MANAGER may require SELLER to demonstrate other functions or processes not listed in Supplement 01750-A.
- D. PROJECT MANAGER's approval of the demonstration of operation with the control software is required before the commissioning of the facility shall commence.
- E. Assist in the implementation of the BUYER provided software configuration as directed by PROJECT MANAGER.

1.09 RECORD KEEPING

- A. SELLER shall maintain, as a minimum, the following records generated during starting and adjusting activities:
 - 1. Daily logs of equipment testing identifying all tests conducted and outcome.
 - 2. Logs of time spent by Manufacturer's Representatives performing services on the job site.
 - 3. Equipment lubrication records.
 - 4. Electrical phase, voltage, and amperage measurements.
 - 5. Insulation resistance measurements.
 - 6. Data sheets of control loop testing including testing and calibration of instrumentation devices and set points.

1.10 TEST REPORTS

- A. The SELLER shall submit to the PROJECT MANAGER three copies of a written report within 10 days after completion of the process performance tests presenting the results of the mechanical startup tests and the process performance tests. The information collected will be the basis for determining acceptability of the HRC System results. In case of conflict, interpretations and calculations made by the PROJECT MANAGER will govern.
- B. The report shall include all data collected during the tests including, but not limited to, the following:
 - 1. Certified letter that all equipment components in the HRC System have been properly installed and lubricated, are in accurate alignment, are free from any undue stress imposed by connecting piping or anchor bolts, have been operated under full load conditions, have been performance tested properly, and have met all specified design, performance and capacity requirements.
 - 2. Original data sheets and summarized results for the HRC System for the following:
 - a. Influent flow rates
 - b. Influent, effluent, and percent removal of TSS
 - c. Influent, effluent, and percent removal of BOD₅
 - d. Influent, effluent, and percent removal of Soluble BOD₅

- e. Influent, effluent, and percent removal of CBOD₅
- f. Influent, effluent, and percent removal of COD
- g. Influent, effluent, and percent removal of Soluble COD
- h. Influent, effluent, and percent removal of fecal coliform
- i. Influent, effluent, and percent removal of Turbidity
- j. Influent and effluent water temperature (degrees C)
- k. Influent and effluent pH
- l. Influent and effluent iron
- m. Coagulant feed rates
- n. Polymer feed rates and feed points
- o. Microsand content (mg/L) from hydrocyclone underflows and overflows (Actiflo® only)

1.11 Performance Guarantee:

- A. Results from the process performance tests shall constitute compliance or noncompliance of the HRC System equipment with the designated performance requirements in these specifications.
- B. Consistent compliance with design conditions shall be defined as the average of sample valves meeting or exceeding the specified design conditions during the testing period. In addition, any time for the HRC System to achieve the specified performance beyond that as required in Section 01111 - Facility and Operational Plan Submittal Requirements.
- C. In the event that any equipment component of the HRC system does not meet the requirements of the specifications during the performance tests, or the system requires higher coagulant or polymer feed rates than specified to achieve compliance, the SELLER shall be permitted to make such changes in the equipment and methods of operation as deemed necessary and as acceptable to PROJECT MANAGER.
- D. Costs of any modifications to achieve compliance will be the SELLER's responsibility, unless they are on equipment not provided under these specifications.
- E. The necessary adjustments shall be made as soon as practicable.
- F. Following the adjustments, the SELLER, in conjunction with the BUYER's Contractor shall be responsible for re-testing the system to show compliance.
- G. In the event that the HRC Goods still do not achieve the specified performance during the second test, the equipment may be subject to rejection.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUPPLEMENTS

- A. Supplement 01750-A - Process Control Test Certification.

—END OF SECTION—

SUPPLEMENT 01750-A
Process Control Test Certification Schedule

Description of Test	Compliant	Rejected	Comments
Mechanical Startup Testing			
Process Optimization Testing			
Process Performance Testing			
Process Demonstration			
Software Demonstration			

SELLER certifies the items listed in Schedule 01750-A have been tested and the results shown are accurate.

Firm Name

Print Name

Title

Signature

—END OF SUPPLEMENT—

SECTION 01775

CLOSEOUT SUBMITTALS AND PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Definitions.
 - 2. Delivery of closeout submittals.
 - 3. Warranty review meeting.
 - 4. Supplements.

1.02 DEFINITIONS

- A. Treatment Plant - Willow Lake Water Pollution Control Facility, 5915 Windsor Island Road N., Salem, OR, 97303-6197.
- B. PEFTF at River Road Park, 3045 River Road N., Salem, OR, 97303.

1.03 DELIVERY OF CLOSEOUT SUBMITTALS

- A. Provide closeout submittals as indicated in Supplement 01775-A - Schedule of Closeout Submittals.
- B. Deliver spare parts and record drawings, to BUYER at the treatment plant, prior to Substantial Completion review.
- C. Deliver the closeout submittals, other than spare parts and record drawings, to BUYER at the Treatment Plant, prior to issuance of Certificate of Substantial Completion.
- D. Provide seven days written notice to PROJECT MANAGER prior to delivering spare parts.
- E. PROJECT MANAGER will inventory the spare parts with SELLER, and provide a receipt for the spare parts received in good condition.
- F. Request final payment pursuant to paragraph 10.05, Section 00700 - General Conditions.

1.04 WARRANTY REVIEW MEETING

- A. The purpose of the meeting is to meet with SELLER to review the Project approximately 11 months following equipment start-up.
- B. Attendance at the meeting is required of PROJECT MANAGER and SELLER.
- C. PROJECT MANAGER will arrange the meeting at least 15 days in advance of the meeting date, or as may be agreed upon by PROJECT MANAGER and SELLER.
- D. PROJECT MANAGER will review the Work and develop a list of items to be completed or corrected, as appropriate.
- E. Complete or correct defective materials and equipment pursuant to paragraph 8.02, Section 00700 - General Conditions.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.01 SUPPLEMENTS

- A. Supplement 01775-A - Schedule of Closeout Submittals.

—END OF SECTION—

Supplement 01775-A
Schedule of Closeout Submittals

Item No.	Item Description	Specification Reference
1	Final Application for Payment	00700, Paragraph 10.05
2	Quality Control Submittals	01330
3		

—END OF SUPPLEMENT—

SECTION 01785

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Definitions.
 - 2. General Requirements.
 - 3. Submittal Procedure.
 - 4. Content Requirements For Manuals.
 - 5. Supplements.

1.02 DEFINITIONS

- A. Maintenance Operation. Routine operation required to ensure satisfactory performance and longevity of Goods. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.03 GENERAL REQUIREMENTS

- A. Provide operation and maintenance data for items listed in Supplement 01785-A - Schedule of Goods Requiring Operation and Maintenance Data.
- B. In addition to the composite operational and maintenance manual for individual Goods items or systems, provide a consolidated summary of required routine scheduled maintenance and scheduled preventative and predictive maintenance for the project, with reference to where detailed information may be found. Include safety information and emergency plans and procedures. The summary shall be in a separate binder from other Goods and system binders.
- C. Comply with the following format relating to the Operation and Maintenance Manual:
 - 1. Size 8 ½-inch by 11-inch.
 - 2. Paper: 20- pound minimum, white for typed pages.
 - 3. Text: Manufacturer's printed data, or neatly typewritten. Facsimiles transmitted via a fax machine shall be unacceptable.
 - 4. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.

5. Provide fly-leaf for each separate Good, or each piece of operating Goods, with typed description of Goods and major component parts of Goods and provide with heavy section dividers with numbered plastic index tabs.
6. Provide each manual with title page, typed table of contents with consecutive page numbers. Plan contents of entire set, identified by volume number, in each binder.
7. Cover: identify each volume with typed or printed title "OPERATION AND MAINTENANCE MANUAL, VOLUME NO._OF_", if applicable and list:
 - a. City of Salem, PEFTF at River Road Park (HRC Procurement)
 - b. City Project Number 702056
 - c. Designate the system or Goods for which it is intended.
 - d. Identify general subject matter covered in manuals.
 - e. Identify Goods number and specifications sections.
8. Assemble and bind material in same order as specified, as much as possible.
9. Material shall be suitable for reproduction, with quality equal to original. Photocopied photographs are not acceptable.
10. Binders:
 - a. Commercial quality, substantial, permanent, "D" ring, three ring type binders with durable, cleanable, plastic binders. Size to eliminate "bulged" condition.
11. Table of Contents neatly typewritten, arranged in a systematic order containing, as a minimum, the follow data:
 - a. SELLER, name of responsible principal, address, and telephone number.
 - b. List of each Good required to be included, and indexed to content of each volume.
 - c. List for each Good: Name, address, and telephone number of sub-contractor, supplier, installer, and maintenance contractor, as appropriate.
 1. Provide local source of supply for parts and replacement.
 - d. Identify each Good by name, model number, and other identifying numbers or symbols as set forth in Contract Documents.
12. Goods Data:
 - a. Include only those sheets that are pertinent to specific Goods provided.
 - b. Clearly annotate each sheet to:
 1. Identify specific Goods or part installed.
 2. Identify data applicable to installation.
 3. Delete references to inapplicable information.
13. Drawings: Supplement Goods data with Drawings as necessary to clearly illustrate:
 - a. Relations of component parts of Goods and Systems.
 - b. Control and flow diagrams.
 - c. Coordinate drawings with project record documents to assure correct illustration of completed installations.
 - d. SELLER shall not use Project record documents as maintenance manual drawings.
 - e. Provide reinforced punched binder tab, bind with text.

- f. Reduced 8 ½- inch by 11-inch, or 11 inches by 17 inches folded to 8 ½-inch by 11-inch.
 - g. Where reduction is impractical, fold and place in 8½ inches by 11-inch envelopes bound in text.
 - h. Identify Specification section and Goods on Drawings and envelopes.
- 14. Instructions and Procedures: Within text, as required to supplement Goods data:
 - a. Handling, storage, maintenance during storage, assembly, erection, installation, adjusting, testing, operating, shutdown in emergency, troubleshooting, maintenance, interface, and as may otherwise be required.
 - b. Organize in a consistent format under separate heading for each different procedure.
 - c. Provide a logical sequence of instructions for each procedure.
 - d. Provide information sheet for BUYER's personnel, including:
 - 1) Proper procedures in the event of failure.
 - 2) Instances that might affect the validity of warranties or bonds.

D. Electronic format shall be the latest version of WordPerfect.

1.04 SUBMITTAL PROCEDURE

- A. Compile the required data, arrange it as specified herein and insert data in the number of volumes necessary. The volumes shall be submitted as a complete set. Partial or incomplete manuals shall be rejected by PROJECT MANAGER.
- B. Preliminary Manuals:
 - 1. Submit three discs to PROJECT MANAGER for review.
 - 2. If accepted:
 - a. One copy will be returned to SELLER.
 - b. One copy will be forwarded to Resident Project Representative.
 - c. One copy will be retained in PROJECT MANAGER's file.
 - 3. If rejected:
 - a. Two copies will be returned to SELLER with PROJECT MANAGER's comments for revision.
 - b. One copy will be retained in PROJECT MANAGER's file.
 - c. Resubmit three revised preliminary copies for PROJECT MANAGER's review.
- C. Final Manuals:
 - 1. Submit five discs to PROJECT MANAGER for review.
 - 2. If Final Manuals are acceptable, SELLER will be so notified.

3. If rejected, and at PROJECT MANAGER's option:
 - a. All copies will be returned to SELLER for revisions.
 - b. All copies will be retained by PROJECT MANAGER and the necessary
 - c. revisions data will be requested from SELLER.

1.05 CONTENT REQUIREMENTS FOR MANUALS

- A. Content for Each Unit (or common units) and System:
 1. Description of unit and component parts, including controls, accessories, and appurtenances:
 - a. Function, normal operating characteristics and limiting conditions.
 - b. Performance curves, engineering data, nameplates data, and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 2. Process narrative for system in which Goods is part of.
 3. Programmable Logic Controllers:
 - a. Programming description
 - b. Screen descriptions and navigation
 - c. OIT function
 4. Operating Procedures:
 - a. Start-up, break- in routine, and normal operating instructions.
 - b. Test procedures and results of factory tests where required.
 - c. Regulation, control, stopping, and emergency instructions.
 - d. Description of operation sequence by control manufacturer.
 - e. Shutdown instructions for both short and extended durations.
 - f. Summer and winter operating instructions, as applicable.
 - g. Safety precautions
 - h. Special operating instructions.
 - i. Installation instructions.
 5. Maintenance and Overhaul Procedures
 - a. Routine operations
 - b. Guide to troubleshooting
 - c. Disassembly, removal, repair, reinstallation, and reassembly.
 6. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
 7. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
 8. Parts list, by generic title and manufacturer's ID number.
 9. Name, location and telephone number of nearest supplier and spare parts warehouse.
 10. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, terminals).
 11. Manufacturer's printed operating and maintenance instructions.
 12. Charts of valve tag numbers, with the location and function of each valve.

13. Manufacturer's certifications including calibration data sheets and specified calibration procedures and/ or methods, for installed Goods.
14. Warranty forms and information for all installed Goods provided by SELLER.

B. Content for Maintenance Summary Manual

1. Compile individual Maintenance Summaries for each applicable Goods item, respective unit or system, and for components or subunits.
2. Format:
 - a. Use Supplement 01785-B - Maintenance Summary.
 - b. Each Maintenance Summary may take as many pages as required.
 - c. Use only 8½-inch by 11-inch size paper.
 - d. Complete using typewriter or electronic printing.
3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommended type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
 - a. Include a list of spare parts and consumable parts recommended by the manufacturer to be stocked on site. Data shall be consistent with manufacturer's bill of materials/parts list furnished in operation and maintenance data manuals.
 - b. "Unit" is the unit of measure for ordering the part.
 - c. "Quantity" is the number of units recommended.
 - d. "Unit Cost" is the current purchase price. Provide a current unit cost for all parts listed.

C. Content for Each Electric or Electronic Item or System:

1. Description of unit and component parts:
 - a. Function, normal operation characteristics, and limiting conditions.
 - b. Performance curves, engineering data, nameplate data, and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 - d. Interconnection wiring diagrams, for control systems.
2. Circuit Directories of All Existing Panels.
 - a. Electrical.
 - b. Control.
 - c. Communication.
3. List of electrical relay settings, and control and alarm contact settings.
4. System wide electrical and control interconnection wiring diagram.
5. As-provided, CAD generated, control diagrams by control manufacturer.
6. Operating procedures
 - a. Routine and normal operating instructions.
 - b. Sequence required.
 - c. Safety precautions.
 - d. Special operating instructions.

7. Maintenance Procedures
 - a. Routine operations.
 - b. Guide to trouble shooting.
 - c. Adjustment and checking.
 - d. List of relay settings, control and alarm contact settings.
8. Manufacturer's printed operating and maintenance instructions.
9. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.

PART 2 GOODS - NOT USED

PART 3 EXECUTION

3.01 SUPPLEMENTS

- A. Supplement 01785-A - Schedule of Goods Requiring Operation and Maintenance Data
- B. Supplement 01785-B - Maintenance Summary Form.

—END OF SECTION—

Supplement 01785-A
Schedule of HRC Goods Requiring Operation and Maintenance Data

[illegible]

—END OF SUPPLEMENT—

Supplement 01785-B
Maintenance Summary Form

PROJECT NAME _____ PROJECT NUMBER _____

GOODS _____

MANUFACTURER _____

GOODS TAG NUMBER _____

WEIGHT OF INDIVIDUAL COMPONENTS IF OVER 100 LBS _____

NAME PLATE DATA _____

MANUFACTURER'S LOCAL SUPPLIER _____

NAME _____ PHONE NUMBER _____

ADDRESS _____

MAINTENANCE REQUIREMENTS	FREQUENCY REQUIRED	LUBRICANT REQUIRED

—END OF SUPPLEMENT—

SECTION 01810

COMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Definitions.
 - 2. Requirements for Commissioning.

1.02 DEFINITIONS

- A. Commissioning Verification Period - The commissioning period begins after the PROJECT MANAGER has approved the process control test certification, the specified demonstration and training is complete, punch list deficiencies are corrected, and the final operation and maintenance manuals are approved. The duration of the commissioning verification period is 14 days without a significant interruption.
- B. Significant Interruption - may include any of the following events:
 - 1. Failure of critical equipment unit, system, or subsystem that is not satisfactorily corrected within two hours after failure.
 - 2. Failure of noncritical equipment unit, system, or subsystem that is not satisfactorily corrected within 24 hours after failure.
 - 3. As may be determined by PROJECT MANAGER.

1.03 REQUIREMENTS FOR COMMISSIONING

- A. Commissioning of the facility shall be completed prior to Substantial Completion.
- B. SELLER to provide the labor, tools, equipment, instruments, and services required for, and incidental to, supporting the BUYER's Contractor's staff during facility commissioning.
- C. The SELLER shall demonstrate satisfactory operation of the equipment and systems provided under these specifications in actual operation as a functional unit.
- D. SELLER to provide adequate staff to support the BUYER's Contractor's commissioning for a period of 14 continuous days without a significant interruption.

- E. At the option of the PROJECT MANAGER, the Commissioning Verification Period shall restart with the correction of each Significant Interruption.
- F. SELLER to correct defects in material and workmanship associated with the Goods provided under these specifications immediately following their discovery.
- G. SELLER to provide technical assistance to the BUYER's Contractor who will be responsible to perform maintenance pursuant to the operation and maintenance data requirements for the new facility during and following the Commissioning Verification Period and prior to issuance of a Certificate of Substantial Completion.
- H. As of the date on the Certificate of Substantial Completion, BUYER's staff shall be responsible for operation and maintenance of the new facilities. This excludes any issues identified as warranty matters.

PART 2 GOODS - NOT USED

PART 3 EXECUTION - NOT USED

—END OF SECTION—

SECTION 01820

OPERATIONS AND MAINTENANCE DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Definitions.
 - 2. General Requirements.
 - 3. Supplements.

1.02 DEFINITIONS

- A. Facility Operators. BUYER's personnel authorized to operate equipment, but not authorized or trained to service equipment.
- B. Maintenance Personnel. BUYER's personnel authorized to service equipment.
- C. Maintenance Training Requirements. Cover as a minimum, equipment schematics, control strategy, troubleshooting procedures, recommended maintenance and periodic testing procedures, advanced start-up procedures, and control Input/Output (I/O) and communications review. Maintenance training shall require one morning session for each type of process equipment.
- D. Manufacturer's Representative. Authorized service division employee of the manufacturer.
- E. Operator Training Requirements. Cover proper use of, and function of, selector switches, reset buttons, how to read and operate the Operator Interface Terminals (OIT) for operating characteristics. Operator training shall require one morning and one afternoon training session for each type of process equipment.

1.03 GENERAL REQUIREMENTS

- A. Provide training for Facility Operators and Maintenance Personnel, for the items listed in Supplement 01820-A - Schedule of Equipment Requiring Demonstration Training.
- B. Utilize Manufacturer's Representative to conduct training sessions.

- C. SELLER shall have an employee familiar with the details of the installation attend training sessions.
- D. The Manufacturer's Representative and SELLER shall provide the demonstration and training required to meet the performance specified herein. No costs in addition to the original Bid shall be incurred by the BUYER to meet this requirement.
- E. The Facility Operator's training sessions shall cover the Operator Training Requirements, and in no case shall that training session duration be less than 30 minutes.
- F. The Maintenance Personnel training sessions shall include the Maintenance Training Requirements, and in no case shall that training session duration be less than four hours.
- G. Schedule and coordinate training sessions to accommodate the following:
 - 1. Provide 14-day written notice to PROJECT MANAGER for approval prior to proposed training sessions.
 - 2. Do not schedule sessions between November 15 and January 2. Do not schedule training sessions for Monday, Friday, Saturday, or Sunday.
 - 3. No more than two different types of equipment training sessions shall be scheduled for any seven day period.
 - 4. Maintenance Personnel shall attend the morning operator training session. The maintenance training shall commence immediately following the operator training.
 - 5. The preferred schedule for operator training sessions of two hours or less is Wednesdays at 8:15 AM and 4:15 PM, to accommodate staff from other shifts.
 - 6. The preferred schedule for operator training sessions greater than two hours is Wednesdays at 8:15 AM and Thursdays at 2:15 PM.
 - 7. Should the schedule require more than one type of equipment training session in a seven day period Tuesdays would be the preferred day for that training.
 - 8. The Manufacturer's Representative shall utilize the operation and maintenance manuals as a basis for instruction. Should the need for additional data become apparent during instruction, SELLER shall prepare and insert the additional data before commencing the commissioning of the facility.
 - 9. BUYER reserves the right to video tape the training session. The BUYER agrees that the video tape shall only be used on site for training employees.
 - 10. Provide the material, data, and training aids including but not limited to, the copying of any documents, screens, viewers, etc. required for the training sessions.
 - 11. Provide an outline of the topics for discussion during the training session and operation and maintenance manuals for all training session participants.

12. BUYER will provide the SELLER with the number of participants at each training session seven days prior to the scheduled training session.

- H. PROJECT MANAGER shall not authorize the commencement of demonstration and training sessions until functional demonstration testing has been completed, indicated by PROJECT MANAGER's receipt of reports required in Section 01750 - Starting and Adjusting.
- I. If SELLER fails to show up at the intended training date, BUYER shall be entitled to notification of a new date complying with the requirements indicated herein.
- J. Training sessions shall be scheduled to allow for an appropriate progression of the training material. If knowledge of certain equipment is necessary to adequately comprehend the operational and maintenance aspects of another piece of equipment, the training sessions shall be scheduled to provide for this requirement.
- K. Training sessions shall meet the following general requirements:
 - 1. Training sessions shall be completed within the Contract Time.
 - 2. SELLER shall provide labor, process medium, chemicals, tools, equipment, and instruments necessary to accommodate the demonstration of the equipment. SELLER may not rely on adequate sewage flows, at time of training, as weather may cause flows to vary.
 - 3. SELLER shall provide evidence of compliance with paragraph 1.03.B above, for approval by PROJECT MANAGER, with the scheduling notice.
 - 4. The content of training sessions shall be specific to the Goods installed.
 - 5. Separate or combined training sessions shall be provided for Facility Operators and Maintenance Personnel as indicated in Supplement 01820-A - Schedule of Equipment Requiring Demonstration and Training.
 - 6. The training sessions shall be developed to allow for appropriate presentation of information and hands-on operation and maintenance opportunities for BUYER's staff.

PART 2 GOODS - NOT USED

PART 3 EXECUTION

3.01 SUPPLEMENTS

- A. Supplement 01820-A - Schedule of Equipment Requiring Demonstration and Training

—END OF SECTION—

Supplement 01820-A
Schedule of HRC Equipment Requiring Demonstration and Training

Item No.	Item Description	Combined Training	Facility Operator Training	Maintenance Personnel Training
1	HRC Equipment		X	X
2	Programmable Logic Controllers		X	X
3	Miscellaneous Process Valves			X
4	Butterfly Valves			X
5	Instruments		X	

—END OF SUPPLEMENT—

SECTION 11511

HIGH RATE CLARIFICATION (Actiflo®) SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes - This Section covers a Actiflo® high rate clarification system (HRC) as manufactured by U.S. Filter-Kruger Products. Each HRC system shall be installed in a concrete structure constructed by BUYER's Contractor under a separate contract.
- B. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures

1.02 RELATED SECTIONS

- A. Section 11515 - High Rate Clarification (HRC) System Equipment

1.03 REFERENCES

- A. American National Standard Institute (ANSI)
 - 1. B16.5 - Cast Iron Flanges and Flanged Fittings Classes 25, 125, and 250
- B. American Standard Testing Materials (ASTM)
 - 1. A36 - Standard Specification for Carbon Structural Steel

1.04 DEFINITIONS

- A. AFBMA - Anti-Friction Bearing Manufacturers Association
- B. BHN - Birnell Harness Number
- C. Microsand - Fine sand used as a ballast to enhance floc formation
- D. Start-up Time - The elapsed time between the moment when treated wastewater is first discharged from the outlet of the HRC (Actiflo®) process, and the moment that the quality of the discharged wastewater begins to consistently meet guaranteed performance requirements.

1.05 SYSTEM DESCRIPTION

A. Actiflo® System Description.

1. Influent wastewater will enter the HRC at the bottom of the coagulation chamber. A coagulation mixer will provide additional mixing of the coagulant already dispersed in the flow. PH in the coagulation chamber will be measured by a pH meter. Flow will exit the coagulation chamber over a submerged concrete weir and will enter the injection chamber.
2. Recirculated Microsand will enter the injection chamber through an underflow pipe from the hydrocyclone box above. The polymer feed system will feed polymer to the injection chamber or the hydrocyclone box where polymer will enter along with recirculated Microsand. An injection mixer will mix Microsand and polymer with the flow forming tiny ballasted floc particles. Flow will exit the injection chamber at the bottom through a rectangular opening in the wall and will enter the flocculation chamber.
3. The flocculation chamber will provide detention time for the formation of larger ballasted flocculant particles. A flocculation mixer will keep the ballasted floc particles suspended. An adjustable frequency drive will allow the speed of the flocculation mixer to be changed. Flow will exit the flocculation chamber over a submerged concrete weir and will enter the settling chamber.
4. The settling chamber will provide a quiescent zone where ballasted floc will settle to the bottom and be removed from the flow. A Microsand/sludge scraper assembly will push the settled floc along the sloped floor into a bottom center pit where it will be pumped out by Microsand/sludge recirculation pumps. A wear plate installed in the bottom center pit will prevent concrete wear at that location. An adjustable frequency drive will allow the speed of the scraper assembly to be changed. Additional floc particles will be removed from the flow as it travels up through Lamella settling plates. A settling plate separation box will prevent short circuiting of flow around the Lamella settling plates. Turbidity at the top of the settling chamber will be measured by a turbidimeter. Flow will exit the settling chamber through notches in collection troughs located above the Lamella settling plates and will discharge in the HRC effluent channel.
5. Microsand/sludge recirculation pumps will pump settled ballasted floc from the settling chamber bottom center pit to the hydrocyclones. Each pump will have its own dedicated hydrocyclone that will use a vortex motion to separate lighter sludge from heavier Microsand. Microsand and water will discharge from the bottom of the hydrocyclone, while sludge and water will discharge from the top through hydrocyclone header assemblies. The hydrocyclones will be installed on a hydrocyclone box that will return Microsand to the injection chamber and sludge through a pipe back to the wastewater collection system.

- B. Design Requirements, Performance Requirements
1. Design parameters based on a peak 80 gpm/sq. ft. overflow rate for each Actiflo[®] train to adhere to the following:
 - a. Coagulation Chamber
 - 1) Number of chambers per train - 1
 - 2) Hydraulic retention time at design flow, sec - 90
 - 3) Side water depth, approx., ft-in - 23'-0"
 - 4) Mixer "G" at 20°C, sec⁻¹ - 265
 - 5) Maximum motor speed, rpm - 1200
 - b. Injection Chamber
 - 1) Number of chambers per train - 1
 - 2) Hydraulic retention time at design flow, sec - 90
 - 3) Side water depth, approx., ft-in - 23'-0"
 - 4) Mixer "G" at 20°C, sec⁻¹ - 265
 - 5) Maximum motor speed, rpm - 1200
 - c. Flocculation Basin
 - 1) Number of basins per train - 1
 - 2) Hydraulic retention time at design flow, sec - 360
 - 3) Side water depth, approx., ft-in - 23'-0"
 - 4) Mixer "G" at 20°C, sec⁻¹ - 185
 - 5) Maximum motor speed, rpm - 1200
 - d. Sedimentation Basin
 - 1) Number of basins per train - 1
 - 2) Rise rate at design flow, gpm/ft² - 80
 - 3) Side water depth at center, approx., ft-in - 23'-0"
 - 4) Adjustable frequency drive - yes
 - e. Residuals Removal and Microsand Recirculation System
 - 1) Number of systems per train - 1
 - 2) Number of Microsand/residuals pumps per system - 3 (2 duty + 1 standby)
 - 3) Adjustable frequency drive for pumps - By Others
 - 4) Number of hydrocyclones and header assemblies per system - 5
 - 5) Number of hydrocyclones boxes per system - 1
- C. Principal Items - Principal items to be included in the Actiflo[®] system for each train are as follows:
1. Mixing Equipment
 - a. One (1) coagulation mixer with anti-vortex baffle
 - b. One (1) injection mixer with anti-vortex baffle
 - c. One (1) flocculation mixer with anti vortex baffle (Driven by variable frequency drive supplied by others)

2. Settling Equipment
 - a. One (1) Microsand/residuals scraper assemblies (Driven by variable frequency drive supplied by others)
 - b. One (1) plate settlers with supports
 - c. One (1) collection troughs with supports
 - d. One (1) wear plate for bottom center hoppers
 - e. One (1) scraper drive shaft protector
3. Residuals Removal and Microsand Recirculation System Equipment
 - a. Three (3) Microsand/residuals pumps
 - b. Three (3) seal water systems
 - c. Four (4) hydrocyclones
 - d. Four (4) hydrocyclone header assemblies and fittings
 - e. One (1) hydrocyclone box
 - f. One (1) hydrocyclone with header assembly, for Microsand washing/removal from any basin
4. Coagulant and Polymer Systems
 - a. Two (2) coagulant feed pump (1 duty + 1 standby)
 - b. Two (2) polymer dilution/feed system (1 duty + 1 standby)
 - c. Two (2) polymer transfer pump (1 duty + 1 standby)
 - d. One (1) coagulant storage tank
5. Controls and Instrumentation
 - a. One (1) programming of the BUYER's supervisory control system or programmable logic controller
 - b. One (1) main control panel
 - c. Three (3) pressure switches with diaphragm seal and isolation valve
 - d. Two (2) pH meters (one located in common feed channel and one per train)
 - e. Two (2) turbidimeters (one located in common feed channel and one per train)
 - f. Eleven (11) pressure gauges with diaphragm seal and isolation valve
6. Mechanical Accessories
 - a. Ten (10) plug valves
 - b. Six (6) solenoid valves
 - c. Three (3) flushing connections with ball isolation valve

1.06 SUBMITTALS

- A. Goods Data
 1. Pursuant to Section 01330 - Submittal Procedures
 2. Detailed specifications and drawings containing complete piping and flow diagrams of the proposed installation, including dimensions, weights, and complete parts lists. Drawing shall show proposed support and anchorage of

equipment and appurtenances and equipment relationship to other parts of the work including clearances for installation.

3. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 GOODS.
4. Microsand/Residuals Pumps
 - a. Name of manufacturer
 - b. Type and model
 - c. Design rotational speed
 - d. Size of pump suction inlet
 - e. Size of pump discharge
 - f. Type and ratings of bearings
 - g. Net weight of pump only
 - h. Weight of the combined pump, motor, and base.
 - i. Overall pump dimensions
 - j. Maximum bhp requirement of pump at any total head above specified minimum for continuous operation
 - k. Maximum diameter of test sphere
 - l. Complete performance curves showing capacity, head, NPSH requirements, efficiency, and bhp requirements over the full operating range
 - m. Shaft diameter
 - n. Type of pump seal
 - o. Data on shop painting
5. Motors
 - a. Name of manufacturer
 - b. Type and model
 - c. Bearings type and lubrication
 - d. Horsepower rating and service factor
 - e. Temperature rating
 - f. Full load rotational speed
 - g. Net weight
 - h. Efficiency at full load, 3/4 load, 1/2 load, and rated conditions
 - i. Full load current
 - j. Locked rotor current
 - k. Shaft diameter
 - l. Overall dimensions
6. Hydrocyclones
 - a. Name of manufacturer
 - b. Type and model
 - c. Materials of construction
 - d. Design, maximum, and minimum flow rates for inlet, underflow outlet and overflow outlet

- e. Sizes of inlet, underflow outlet and overflow outlet
 - f. Net weight
 - g. Data on shop painting
 - h. Overall dimensions
7. Hydrocyclone Header Assemblies and Fittings
 - a. Name of manufacturer for each component
 - b. Type and model for each component
 - c. Sizes of each component
 - d. Materials of construction for each component
 - e. Net weight of assemblies
 - f. Data on shop painting
 - g. Overall dimensions of assemblies
 - h. Schematics of complete hydrocyclone header assemblies and fittings
 8. Hydrocyclone Boxes
 - a. Name of manufacturer/fabricator for each item
 - b. Type and model for each item as applicable
 - c. Materials of construction for each item
 - d. Details of fabrication for each item
 - e. Net weight for each item
 - f. Data on stainless steel cleaning for each item
 - g. Complete dimensions of each item
 - h. Overall dimensions
 - i. Complete supports details
 9. Programming Coordination
 - a. Database, PLC register, or other data needed by the Actiflo® system PLC (i.e., operator input, run status, etc.).
 - b. Database, PLC register, or other data output from the Actiflo® System (i.e., alarm, system running, etc.).
 - c. Operator interface screen requirements needed to monitor and control the system from the Plant Control System.
 10. Pressure Switches, pH Meters, turbidimeters, level transmitters, sludge blanket level indicators, level detectors, magnetic flow meters, and pressure gauges with diaphragm seals: Submittals shall be in accordance with the provisions of the instrumentation section.
 11. Field Tests
 - a. Testing schedule
 - b. Detailed written test procedures for mechanical startup testing, and optimization and process performance testing
 - c. Forms for data collection
 - d. Calculation formulas
 - e. Description of sample collections, and analyses required
 12. Operation and maintenance manuals

- a. Provide a complete operation and maintenance manual for the Actiflo[®] system in accordance with the requirements of Section 01785 - Operation and Maintenance Data.
 13. Wiring, control schematics, and control logic for electrical and control components furnished.
 14. List of special tools for each type of equipment furnished, including special tools necessary for adjustment operation, maintenance and disassembly.
- B. Shop Drawings
 1. Submit five (5) complete sets
 2. Complete control panel layout drawings
 3. Loop wiring diagrams to include:
 - a. Complete wiring system for Actiflo[®] equipment showing wiring terminations
 - b. Terminal connection points for equipment and system inputs outside of the Actiflo[®] system.
- C. Quality Assurance/Control Submittals
 1. Design Data
 2. Manufacturers' Instructions - Installation and checkout instructions including lubrication and initial start-up procedures.
 3. Manufacturers' Field Reports - Indicate personnel and actual tests and start-up procedures that were performed by manufacturer's representative.
- D. Closeout Submittals
 1. Pursuant to Section 01775 - Closeout Submittals and Procedures

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading
 1. Shipping, handling, and unloading shall be pursuant to Section 01600 - Goods Requirements.
- B. Acceptance at Site
 1. Acceptance of Goods at work site to be pursuant to paragraph 8.01, B of Section 00700 - General Conditions.
- C. Storage and Protection
 1. Goods to be stored in a dry location by BUYER's Contractor responsible for the equipment installation after receipt by BUYER.
 - a. SELLER to provide instructions for proper storage of the goods to BUYER per paragraph 6.02, Section 00700 of the General Conditions.

2. Goods provided to be free of damage.

1.08 PROJECTS CONDITIONS

- A. Project Environmental Requirements - The environmental conditions are those consistent with the treatment of municipal wastewater with the specified process.

1.09 WARRANTY

- A. Correction Period
 1. Pursuant to Section 00700 - General Conditions
- B. Special Warranty
 1. Per Agreement, Section 00500.

1.10 SYSTEM START UP, COMMISSIONING, AND BUYER'S TRAINING

- A. System Start-up
 1. SELLER's Field Technician and/or Senior Field Technician shall coordinate with the BUYER's Contractor the installation, starting, testing and adjusting of the HRC system as indicated in Section 01300 - Special Services.
- B. Commissioning
 1. SELLER's Field Technician and/or Senior Field Technician shall provide Special Services to the BUYER and the BUYER's Contractor during facility Commissioning as indicated in Section 01300 - Special Services.
- C. BUYER's Training
 1. SELLER's Field Technician and/or Senior Field Technician shall provide Special Services to the BUYER to demonstrate operation of the HRC system and for training of BUYER's staff as indicated in Section 01300 - Special Services.

1.11 MAINTENANCE

- A. Extra Materials - Spare Parts and Special Tools
 1. Spare Parts
 - a. Package spare parts with labels indicating the contents of each package. Label shall include manufacturer's name, equipment name, part nomenclature, part number, address of nearest distributor, and current list price.
 - b. Provide the following spare parts for each HRC treatment train:

- 1) Microsand/Residuals Pumps
 - (a) Provide two sets of v-belts and sheaves
 - (b) Provide three sets of packing rings and retainer rings
- 2) Hydrocyclones
 - (a) Six hydrocyclone apexes

1.12 SPECIAL SERVICES DURING BUYER'S FINALIZATION OF DESIGN

- A. SELLER's Designer and Senior Designer to provide process and design engineering Special Services as provided in Section 01300 - Special Services.

PART 2 GOODS

2.01 MANUFACTURERS

- A. The Actiflo® system to be coordinated and supplied as one integrated system by U.S. Filter-Kruger Products.

2.02 EQUIPMENT

- A. Residuals Removal and Microsand Recirculation System Equipment
 1. Materials:
 - a. Casing and Casing Covers - Cast or ductile iron housing fitted with replaceable abrasion resistant rubber liners
 - b. Impeller - Cast or ductile iron
 - c. Shaft - Carbon steel, AISI 1045
 - d. Shaft Sleeve - Ceramic coated stainless steel
 - e. Stuffing Box Hardware - Stainless steel
 - f. Packing Gland and Lantern Ring - 316 stainless steel
 - g. Packing - Braided synthetic fiber, carbon impregnated
 - h. Bearings - Heavy-duty antifriction
 - i. Base - Cast iron or fabricated steel
 2. Provide the following items to be installed at the clarification complex by others:
 - a. Microsand/residuals pumps
 - b. Seal water systems
 - c. Hydrocyclones
 - d. Hydrocyclone header assemblies and fittings
 - e. Hydrocyclone boxes
 - f. Sandloss detection boxes
 3. Microsand/Residuals Pumps

- a. Provide the required number of micorsand/residuals pumps to pump a mixture of Microsand and residuals from the sedimentation basin bottom center hoppers to the hydrocyclones.
- b. Each pumping unit to be complete with a pump, electric motor, belt drive, belt guard, and appurtenances specified or otherwise required for proper operation.
- c. Design each pump to operate at maximum possible efficiency throughout the duty range, without overloading motors.
- d. Pumps to have a continuously falling head/capacity characteristic curve from no flow to maximum flow conditions to ensure satisfactory parallel operation.
- e. Design each pumping unit for the following operating conditions at rated speed, unless otherwise noted:
 - 1) Type of pumping unit - Centrifugal sand slurry
 - 2) Maximum pump speed, rpm - 1,800
 - 3) Rated total head, ft - To be determined by Actiflo® system supplier
 - 4) Minimum shutoff head, ft - 110% of rated head
 - 5) Pump efficiency at rated head - To be determined by Actiflo® system supplier
 - 6) Operating head range, ft - To be determined by Actiflo® system supplier
 - 7) Minimum available net positive suction head at center line of pump shaft, feet absolute - Flooded
 - 8) Minimum hydrostatic test pressure, psi - 1.5 x shutoff head plus maximum suction pressure
- f. Pump performance to be stable and free from cavitation and noise throughout the specified operating conditions.
- g. Casing Assembly
 - 1) Casings to be radially split type with replaceable abrasion resistant liners pressure molded to the backing plate and secured to the casing externally by heavy-duty studs and nuts.
 - 2) Liners to extend through casing nozzles to form natural gaskets between flanges and piping.
 - 3) Flanges to be slotted for easy assembly and disassembly.
 - 4) Provide pumps 8 inch and larger with anti-rotation veins for smooth flow into pump.
 - 5) Casing parts to have tight fits to maintain alignment.
 - 6) Design nozzle flanges to connect to flat faced pipe flanges, in accordance with ANSI/ASME B16.1, Class 125 diameter and drilling.
 - 7) Provide a tapped pipe opening for draining stuffing box leakage.
- h. Impeller

- 1) Impeller to be abrasion resistant rubber, pressure molded to a ductile iron support skeleton, statically balanced, and fully enclosed to protect the veins.
- 2) Impeller to be screwed to the shaft with heavy duty threads running in opposite direction to the shaft rotation.
- i. Shaft and Shaft Sleeves
 - 1) Shaft to be completely machined.
 - 2) Maximum shaft deflection at the stuffing box to be 0.002 inch at any head in the operating range.
 - 3) Provide a suitable splash deflector mounted on the shaft adjacent to the frame bearing housing.
 - 4) Enclose the shaft within the stuffing box by a replaceable coated stainless steel hook-type sleeve extending from the impeller through the stuffing box.
 - 5) Positively secure the sleeve to the shaft and seal to prevent leakage between shaft and the sleeve.
 - 6) Total runout, after assembly, not to exceed 0.002 inch.
- j. Stuffing box
 - 1) Each stuffing box to contain a split lantern ring at least two packing rings in length, at least five packing rings, and split glands at the outboard end.
 - 2) Chesterton Model 442, John Crane Model 37, or "approved equal" items.
 - 3) Gland halves to be interlocked at assembly and held in position by at least two bolts or studs.
 - 4) Provide each box with a 3/4-inch seal water connection at the normal lantern ring position.
- k. Frame Assembly
 - 1) Frame assembly to rigidly support the rotating element with two bearings.
 - 2) Radial pump loads to be carried by the outboard bearing.
 - 3) Provide ample clearance for stuffing box maintenance.
- l. Bearings
 - 1) Provide heavy-duty anti-friction type bearings completely enclosed in an oil-lubricated cast iron cartridge assembly.
 - 2) Bearings to have an AFBMA L₁₀ Life Rating of 40,000 hours at specified operating conditions.
- m. Accessories
 - 1) Provide each pump with lifting eyebolts or lugs; and fittings for properly adding bearing lubricant and seal water.
 - 2) Provide oil lubricated units with constant level oilers or with sight glasses arranged to indicate operating and static oil levels.

- n. Balance
 - 1) Accurately machine impellers, shafts and other rotating parts to be in as nearly perfect rotational balance as practicable.
 - 2) Statically balanced as a unit to ensure freedom from vibration.
 - 3) Excessive vibration will be sufficient cause for rejection of the equipment.
 - 4) Design to avoid resonance at normal operating speeds.
 - 5) Vibration displacement (peak-to-peak), as measured at any point on the machine, must not exceed 5.0 mils.
 - 6) At any operating speed, the ratio of rotational speed to the critical speed of a unit or components thereof to be less than 0.8 or more than 1.3.
- o. Drive Units
 - 1) Each pump to be driven by an electric motor connected to the pump through a V-belt drive.
 - 2) V-belt and sheave groove dimensional tolerances to be in accordance with the "Engineering Standards - Multiple V-Belt Drives" as published by the Multiple V-Belt Drive and Mechanical Power Transmission Association.
 - 3) Speed reduction ratio of V-belt drives not exceed 4 to 1.
 - 4) Sheaves to be of the stationary control type allowing plus or minus 10 percent of rated speed by manual adjustment of the sheaves.
 - 5) Provide provisions for adjusting belt tension.
 - 6) Provide a fully enclosed, steel belt guard in compliance with OSHA requirements.
 - 7) Drive unit to be piggy-back mounted over the pump.
- p. Electric Motors
 - 1) Drive motors to be totally enclosed fan cooled, rated 460 volt 60 hertz 3 phase, squirrel cage induction type.
 - 2) Provide each motor with a motor space heater rated 120 volt 60 hertz 3 phase.
- q. Seal Water Systems
 - 1) Provide one complete seal water system for each Microsand/residuals pump.
 - 2) Each valve station to include:
 - (a) Isolation valves
 - (b) Strainers
 - (c) Pressure regulating device (optional)
 - (d) Flow regulating device
 - (e) Flow indicator
 - (f) Seal water flow switch with two normally open contacts closing on increasing flow.

- (g) Pressure gauge or gauges
 - (h) Solenoid Valve
 - (i) Flexible connector
- 3) Pressure and flow set points to be as recommended by the pump supplier.
 - (a) Water supply pressure to the seal water system to be approximately 80 pig.
- 4. Hydrocyclones
 - a. Materials:
 - 1) Shell - Polyurethane
 - 2) Vortex Finder - Abrasion resistant alloy
 - b. Provide an adequate number of hydrocyclones as part of the Actiflo[®] process to receive a mixture of Microsand, water and residuals from the Microsand/residuals pumps, separate Microsand from residuals, return Microsand to the Actiflo[®] system trains, and discharge residuals to thickening basin.
 - c. Provide adequate number of units to meet the maximum design flow with one unit as a standby.
 - d. Provide a single hydrocyclone to remove Microsand from any of the Actiflo[®] trains for basin cleaning purposes.
 - e. Hydrocyclone to be sized by the system supplier to meet the system requirements.
 - f. Flow split in each hydrocyclone:
 - 1) Underflow - 20%
 - 2) Overflow - 80%
 - g. Maximum Microsand loss in overflow not to exceed 2.0 mg/L
 - h. Each hydrocyclone to be a heavy-duty cylindrical/conical shell, constructed of polyurethane, designed for highly abrasive applications.
 - i. Each hydrocyclone to be of the cyclone type, utilizing centrifugal force to separate Microsand from the influent flow.
 - j. The hydrocyclones to be supported and mounted in hydrocyclone boxes.
 - k. Provide each hydrocyclone with a vortex finder and apex valve.
 - l. Vortex finders to be made of an abrasion-resistant alloy with an approximate Brinell hardness of 500.
 - m. Provide a hinge and quick-disconnect clamp between the apex assembly and the lower cone section to allow removal of material which may clog the apex, without disconnecting any piping on the hydrocyclone itself.
 - n. Provide a 1 1/4 inch NPT diaphragm protected gauge connection with pressure gauge at the inlet.
 - o. Provide each hydrocyclone with lifting eyebolts or lugs.
- 5. Hydrocyclone Header Assemblies and Fittings
 - a. Materials: 304 stainless steel

- b. Provide a hydrocyclone assembly to connect the hydrocyclone overflows with the hydrocyclone boxes.
 - c. Dimensions, thickness, fabrication details, and details of mounting to the hydrocyclones and the hydrocyclone boxes to be as directed by the system supplier.
6. Hydrocyclone Boxes
- a. Materials: AISI Type 304L stainless steel
 - b. Provide one hydrocyclone box as mounting structures for the hydrocyclones for each treatment basin.
 - c. Provide for mounting the duty and standby hydrocyclones on each of these hydrocyclone boxes.
 - d. The underflow containing Microsand from each hydrocyclone will discharge into the underflow section of its respective hydrocyclone box, where it shall be returned by gravity flow into the injection chamber.
 - e. The overflow containing residuals from each hydrocyclone will discharge into the overflow section of its respective hydrocyclone box, where it will be sent by gravity flow to the sewer.
 - f. Separate each rectangular hydrocyclone box into an underflow section and an overflow section.
 - g. Provide each underflow section with an hinged panel for access to the hydrocyclones.
 - h. Provide each overflow section with a flanged outlet for attachment to stainless steel piping.
 - i. Provide suitable lifting lugs on each hydrocyclone box.
 - j. Each hydrocyclone box shall be fabricated to completely drain.
 - k. Dimensions, thicknesses, fabrication details, and details of mounting to the concrete floor to be as directed by the system supplier.
 - l. Shop fabricate each hydrocyclone box and deliver to the site in one complete unit.
 - m. Field welding to assemble the hydrocyclone boxes will not be acceptable.
7. Sandloss Detection Boxes
- a. Materials: AISI Type 304L stainless steel
 - b. Provide one sandloss detection box for each group of hydrocyclones
 - c. Provide necessary connections for connecting the sandloss detection boxes to the hydrocyclone box overflow.
 - d. Each box to be designed for mounting to a concrete slab.

2.03 ACCESSORIES

A. Reducers

- 1. Provide one pipe reducer for installation on the suction and discharge piping of each Microsand/sludge recirculation pump.

2. Reducers to be constructed of schedule 10 stainless steel with flanged ends.
- B. Plug Valves
 1. Provide eccentric plug valves for use in the recirculation/wasting piping.
 2. Plug valves to be in accordance with the requirements of Section 15224 - Plug Valves.
- C. Solenoid Valves
 1. Provide solenoid valves for use in the Microsand/sludge recirculation pump seal water systems.
 2. Solenoid valves to have packless construction without packing box or sliding seal.
 3. Valves to be rated for 115 V ac, 60 Hz, 1 phase, 40 C ambient.
 4. Enclosure to be NEMA Type 4 with a conduit knockout
 5. Valve construction to be as follows
 - a. Type - 2 way, pilot operated
 - b. Body/Bonnet - Brass or bronze
 - c. Trim
 - 1) Seals - Buna-N or Teflon
 - 2) Disc - Buna-N or Teflon
 - 3) Stem - Manufacturer's standard
 - 4) Bonnet Gasket - Manufacturer's standard
 - 5) Spring - Manufacturer's standard
 - d. Provide valves with threaded end connections
 - e. Valves to be suitable for operation at 32 to 104 F
 6. Valves to be manufactured by ASCO - "8210 Series".
 7. Provide manufacturer's standard protective coating.
- D. Flushing Connections
 1. Flushing connections to consist of a 1 1/4 inch quick disconnect hose coupling and isolation ball valve.

2.04 FABRICATION

- A. Shop Assembly
 1. Equipment to be shop assembled to the maximum extent possible

2.05 FINISHES

- A. Shop Priming, Shop Finishing
 1. Non-submerged steel surfaces to be commercial blast cleaned (SSPC-SP6).
 2. Submerged steel surfaces to be near whit blast cleaned (SSPC-SP10).
 3. Machined surfaces subject to corrosion shall be coated with an easily removable rust preventative compound prior to shipment.

4. Clean, degrease, and pickle items fabricated from stainless steel following fabrication.
 - a. Pickling shall produce a modest etch and shall remove embedded iron and heat tint.
 - b. Subject pickled surfaces to 24 hour water or a ferroxyl test to detect the presence of residual embedded iron.
 - c. Items with traces of iron detected after pickling shall be re-pickled as required to remove iron traces.
- B. Field Painting
 1. Field painting to be the responsibility of the BUYER's Contractor.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Equipment Installation
 1. Equipment provided under this section will be installed by BUYER's Contractor under a separate agreement.

3.02 FIELD QUALITY CONTROL

- A. Special Services to BUYER and BUYER's Contractor
 1. Pursuant to Section 01300 - Special Services
- B. Site Tests, Inspection
 1. Special Services to BUYER for Equipment Checkout, Start-up and Testing, Pursuant to Section 01300 - Special Service.

3.03 ADJUSTING

- A. Special Services to BUYER for Starting and Adjusting, Pursuant to Section 01300 - Special Services.

3.04 DEMONSTRATION

- A. Operation and Maintenance Training
 1. Special Services to BUYER for Operation and Maintenance Training, Pursuant to Section 01300 - Special Services.

3.05 PROTECTION

A. Stainless Steel Surfaces

1. Protect stainless steel surfaces, after pickling, to prevent contact with iron or steel objects or surfaces.

END OF SECTION

SECTION 11512

HIGH RATE CLARIFICATION (DensaDeg®) SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes - This section covers a DensaDeg® high rate clarification system (HRC) as manufactured by ONDEO Degremont, Inc. Each HRC system shall be installed in a concrete structure constructed by a BUYER's Contractor under a separate contract.
- B. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures

1.02 RELATED SECTIONS

- A. Section 11515 - High Rate Clarification (HRC) System Equipment

1.03 REFERENCES

- A. American National Standard Institute (ANSI)
 - 1. B16.5 - Cast Iron Flanges and Flanged Fittings Classes 25, 125, and 250
- B. American Standard Testing Materials (ASTM)
 - 1. A36 - Standard Specification for Carbon Structural Steel

1.04 DEFINITIONS

- A. AFBMA - Anti-Friction Bearing Manufacturers Association
- B. BHN - Birnell Harness Number
- C. Start-up Time - The elapsed time between the moment when treated wastewater is first discharged from the outlet of the HRC (DensaDeg®) process, and the moment that the quality of the discharged wastewater begins to consistently meet guaranteed performance requirements.

1.05 SYSTEM DESCRIPTION

- A. DensaDeg® System Description.

1. Influent sewage enters the HRC through a flash-mixing zone where coagulant is added. The coagulated wastewater then flows through the base of the reactor basin and is discharged beneath an axial flow impeller, within a draft tube. Polymer is injected into the draft tube via a dispersion ring to aid in the flocculation and settleability of the coagulated particles.
2. Recycled solids are introduced in the inlet pipe to the reactor basin to aid coagulation. The movement of the reactor turbine impeller shall provide sufficient energy for the mixing of the chemicals and water. It additionally acts as an axial flow pump by drawing previously formed solids, (which settle external to the flume), into the base of the flume. The internal recycling of previously formed solids enhances the solids contact process and increases the speed of the reactions.
3. Having formed a densely structured precipitate, the flow moves from the reactor basin through a piston flocculation zone to the pre-settling and thickening zone that is contained within the first part of the clarifier/thickener basin. Due to the internal baffle separating the thickener section from the lamellar clarification section, the flow exhibits a downward velocity vector. As the water flows under the baffle and upwards into the lamellar tubes, the downward momentum carries solids to the bottom of the thickener basin. Here the solids are allowed to thicken with the aid of a slowly rotating scraper that pushes the solids into a sludge hopper located at the bottom of the clarifier/thickener basin. This thickened sludge is periodically discharged from the hopper. A part of the sludge inventory is recycled back to the inlet pipe to the reactor basin, thereby increasing the solids in the reactor and improving the performance of the process.
4. Water proceeds beneath the baffle into the clarification zone. Additional solids removal is achieved by the use of lamellar tubes incorporated into the top of the clarification zone. Moving through the lamellar tubes, finished water, is collected through a series of launders, which discharge treated water into the effluent trough.

B. Design Requirements, Performance Requirements

1. Design parameters based on a peak 40 gpm/sq.ft. overflow rate for each DensaDeg® train to adhere to the following
 - a. Flash Mixer Chamber
 - 1) Number of chambers per train - 2
 - 2) Hydraulic retention time at design flow, sec - 70
 - 3) Side water depth, approx., ft-in - 25'-6"
 - 4) Maximum motor speed, rpm - 1200
 - b. Reactor Chamber
 - 1) Number of chambers per train - 2
 - 2) Hydraulic retention time at design flow, sec - 140
 - 3) Side water depth, approx., ft-in - 25'-6".

- 4) Maximum motor speed, rpm - 1200
 - c. Clarifier/Thickener
 - 1) Number of basins per train - 1
 - 2) Rise rate at design flow gpm/sq-ft - 40
 - 3) Hydraulic retention time at design flow, sec - 620
 - 4) Side water depth, approx., ft-in - 25'-6".
 - 5) Drive Horsepower - 1.0
- C. Principal Items - Principal items to be included in the DensaDeg® system for each train are as follows:
1. Mixing Equipment
 - a. Two (2) flash mixers with support system (Driven by variable frequency drive supplied by others)
 - b. Two (2) reactor mixers with support system (Driven by variable frequency drive supplied by others)
 2. Settling Equipment
 - a. One (1) clarifier/thickener scraper mechanism (two arms) (Driven by variable frequency drive supplied by others)
 - b. One (1) clarifier/thickener/drive.
 - c. One (1) lamellar tube settlers.
 - d. One (1) stainless steel launders with adjustable weirs.
 - e. Two (2) scum removal mechanisms with support system.
 - f. One (1) sludge recirculation cone.
 3. Reactor Tank
 - a. Two (2) inner draft tubes with support system.
 - b. Two (2) baffle sets with support system.
 - c. Two (2) polymer distribution piping
 4. Pumps
 - a. One (1) sludge recirculation pump (Driven by variable frequency drive supplied by others)
 - b. One (1) sludge wasting pump (Driven by variable frequency drive supplied by others)
 - c. One (1) to as a backup for both the recirculation and sludge wasting pumps.
 5. Coagulant and Polymer Systems
 - a. Two (2) coagulant feed pump (1 duty + 1 spare)
 - b. Two (2) polymer dilution feed pumps (1 duty + 1 spare)
 - c. One (1) coagulant storage tank
 6. Controls and Instrumentation
 - a. One (1) programming of the BUYER's supervisory control system or programmable logic controller
 - b. One (1) main control panel

- c. Two (2) turbidimeters
- d. One (1) ultrasonic level indicator and transmitter
- e. One (1) sludge blanket detector
- f. Two (2) pH analyzers
- g. Two (2) magnetic flow meters
- 7. Mechanical Accessories
 - a. One (1) eccentric plug valve w/ electric actuator

1.06 SUBMITTALS

A. Goods Data

- 1. Pursuant to Section 01330 - Submittal Procedures.
- 2. Detailed specifications and drawings containing complete piping and flow diagrams of the proposed installation, including dimensions, weights, and complete parts lists. Drawing shall show proposed support and anchorage of equipment and appurtenances and equipment relationship to other parts of the work including clearances for installation.
- 3. Manufacturer's data including materials of construction, equipment weight, complete parts list, and related information for each item specified in PART 2 GOODS.
- 4. Sludge Recirculation/Wasting Pumps
 - a. Name of manufacturer
 - b. Type and model
 - c. Design rotative speed
 - d. Size of pump suction inlet and discharge
 - e. Type size and ratings of bearings
 - f. Net Weight of Pump only
 - g. Weight of combined pump, motor, and base
 - h. Overall pump dimensions
 - i. Maximum bhp requirement of pump at any total head above specified minimum for continuous operation
 - j. Maximum diameter of test sphere
 - k. Complete performance curves showing capacity, head, NPSH requirements, efficiency, and bhp requirements over the full operating range
 - l. Shaft diameter
 - m. Type of pump seal
 - n. Data on shop painting
- 5. Seal Water System
 - a. Name of manufacturer for each component
 - b. Type and model number for each component
 - c. Pressure and flow range for each component

- d. Schematics of complete seal water systems
- 6. Motors
 - a. Name of manufacturer
 - b. Type and model
 - c. Bearings type and lubrication
 - d. Horsepower rating and service factor
 - e. Temperature rating
 - f. Full load rotative speed
 - g. Net weight
 - h. Efficiency at full load, 3/4 load, 1/2 load, and rated conditions
 - i. Full load current
 - j. Locked rotor current
 - k. Shaft diameter
 - l. Overall dimensions
- 7. Programming Coordination
 - a. Database, PLC register, or other data needed by the DensaDeg[®] system PLC (i.e., operator input, run status, etc.).
 - b. Database, PLC register, or other data output from the DensaDeg[®] System (i.e., alarm, system running, etc.).
 - c. Operator interface screen requirements needed to monitor and control the system from the Plant Control System.
- 8. Pressure Switches, pH Meters, turbidimeters, level transmitters, sludge blanket level indicators, level detectors, magnetic flow meters, and pressure gauges with diaphragm seals: Submittals shall be in accordance with the provisions of the instrumentation section.
- 9. Field Tests
 - a. Testing schedule
 - b. Detailed written test procedures for mechanical startup testing, and optimization and process performance testing
 - c. Forms for data collection
 - d. Calculation formulas
 - e. Description of all sample collections, and analyses required.
- 10. Operation and Maintenance manuals.
 - a. Provide a complete operation and maintenance manual for the DensaDeg[®] System in accordance with the requirements of Section 01785 - Operation and Maintenance Data.
- 11. Wiring, control schematics, and control logic for all electrical and control components furnished.
- 12. List of special tools for each type of equipment furnished, including special tools necessary for adjustment operation, maintenance and disassembly.

B. Shop Drawings

1. Submit five (5) complete sets.
 2. Complete control panel layout drawings.
 3. Loop wiring diagrams to include:
 - a. Complete wiring system for the DensaDeg[®] equipment.
 - b. Terminal connection points for equipment and system inputs from outside DensaDeg[®] equipment.
- C. Quality Assurance/Control Submittals
1. Design Data
 2. Manufacturers' Installation Instructions - Installation and checkout instructions including lubrication and initial start-up procedures.
 3. Manufacturers' Field Reports - Indicate personnel and actual tests and start-up procedures that were performed by manufacturer's representative.
- D. Closeout Submittals
1. Pursuant to Section 01775 - Closeout Submittals and Procedures

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading
1. Shipping, handling, and unloading shall be pursuant to Section 01600 - Goods Requirements.
- B. Acceptance at Site
1. Acceptance of Goods at work site to be pursuant to paragraph 8.01, B of Section 00700 - General Conditions.
- C. Storage and Protection
1. Goods to be stored in a dry location by BUYER's Contractor responsible for the equipment installation after receipt by BUYER.
 - a. SELLER to provide instructions for proper storage of the goods to BUYER per paragraph 6.02, Section 00700 of the General Conditions..
 2. Goods provided to be free of damage.

1.08 PROJECTS CONDITIONS

- A. Project Environmental Requirements - The environmental conditions are those consistent with the treatment of municipal wastewater with the specified process.

1.09 WARRANTY

- A. Correction Period

1. Pursuant to Section 00700 - General Conditions

B. Special Warranty

1. Per Agreement, Section 00500.

1.10 SYSTEM START UP, COMMISSIONING, AND BUYER'S TRAINING

A. System Start-up

1. SELLER's Field Technician and/or Senior Field Technician shall coordinate with the BUYER's Contractor the installation, starting, testing and adjusting of the HRC system as indicated in Section 01300 - Special Services.

B. Commissioning

1. SELLER's Field Technician and/or Senior Field Technician shall provide Special Services to the BUYER and the BUYER's Contractor during facility Commissioning as indicated in Section 01300 - Special Services.

C. BUYER's Training

1. SELLER's Field Technician and/or Senior Field Technician shall provide Special Services to the BUYER to demonstrate operation of the HRC system and for training of BUYER's staff as indicated in Section 01300 - Special Services.

1.11 MAINTENANCE

A. Extra Materials - Spare Parts and Special Tools

1. Spare Parts

- a. Package spare parts with labels indicating the contents of each package. Label shall include manufacturer's name, equipment name, part nomenclature, part number, address of nearest distributor, and current list price.
- b. Provide the following spare parts for each HRC treatment train:
 - 1) Sludge Recirculation/Wasting
 - (a) Provide one (1) shaft
 - (b) Provide one (1) shaft coupling
 - (c) Provide one (1) rotor
 - (d) Provide one (1) mechanical seal

1.12 SPECIAL SERVICES DURING BUYER'S FINALIZATION OF DESIGN

A. SELLER's Designer and Senior Designer to provide process and design engineering Special Services as provided in Section 01300 - Special Services.

PART 2 GOODS

2.01 MANUFACTURERS

- A. The DensaDeg[®] system to be coordinated and supplied as one integrated system by ONDEO Degremont, Inc.

2.02 EQUIPMENT

- A. Sludge Recirculation and Wasting Systems
 - 1. Manufacturers: Sludge wasting, sludge recirculation, and chemical transfer pumps to be progressive cavity type as manufactured by Moyno, or Seepex.
 - 2. Materials:
 - a. Casing and Casing Covers - ASTM A 48 Cast iron.
 - b. Stator - Buna-N
 - c. Rotor - Chrome Plated Steel
 - d. Shaft - ASTM A 681 Tool Steel
 - e. Shaft Seal - Mechanical, Single Split Type
 - f. Bearings - Heavy-duty antifriction
 - g. Base - Cast iron or fabricated steel
 - 3. The system consists of the following items
 - a. Sludge Recirculation Pumps.
 - b. Sludge Wasting Pump.
 - c. Seal Water System
 - d. Sludge Blow Down Valve
 - 4. Recirculation/Wasting Pumps
 - a. Variable speed controlled, progressive cavity, recirculation pumps. One pump will serve each reactor chamber. With the third acting a spare pump for each unit. The pumps will be capable of recirculating of solids from the clarifier/thickener to the reactor inlet. Actual rate of recirculation shall be determined during start-up testing.
 - b. Constant speed wasting pump for removing thickened sludge from the clarifier/thickener basin and pumping it back to the interceptor sewer.
 - c. Each pumping unit to be complete with a pump, electric motor, suction and discharge piping (grooved end ductile iron pipe) complete with eccentric plug valves, pressure gauges, and all other appurtenances specified or otherwise required for proper operation.
 - d. Design each pump to operate at maximum possible efficiency throughout the duty range, without overloading motors.

- e. Pumps to have a continuously falling head/capacity characteristic curve from no flow to maximum flow conditions to ensure satisfactory parallel operation.
- f. Design each pumping unit for the following operating conditions at rated speed, unless otherwise noted
 - 1) Type of pumping unit - Progressive Cavity
 - 2) Maximum pump speed, rpm - 1,200
 - 3) Rated total head, ft - To be determined by DensaDeg[®] system SELLER
 - 4) Minimum shutoff head, ft - 110% of rated head
 - 5) Pump efficiency at rated head - To be determined by DensaDeg[®] system SELLER
 - 6) Operating head range, ft - To be determined by DensaDeg[®] system SELLER
 - 7) Minimum available net positive suction head at center line of pump shaft, feet absolute - Flooded
 - 8) Minimum hydrostatic test pressure, psi - 1.5 x shutoff head plus maximum suction pressure
- g. Pump performance to be stable and free from cavitation and noise throughout the specified operating conditions.
- h. Casing Assembly
 - 1) Housing Cover Plates - 2 on suction housing, 1 each side for access to rotor and shaft ends without otherwise dismantling the pump.
 - 2) Design Working Pressure - Not less than the maximum of 1.25 the rated Design Point head or 1.1 times the maximum discharge pressure at the rated maximum revolutions per minute in vendor published information for the furnished model.
 - 3) Suction and discharge piping connections - Flanged meeting ANSI/ASME B 16.1, Class 125, or ANSI/ASME B 16.5, Class 150; provide higher pressure class as required to meet Design Working Pressure.
 - 4) Vent and Taps - Provide casing with both 3/4 inch NPT high point vent and low point drain taps.
- i. Stator and Rotor
 - 1) Number of rotor sealing stages as required.
 - 2) Rotor to manufactured from Tool steel with 0.01 inch minimum chrome plating thickness and finish to Rockwell hardness of not less than C60.
 - 3) Stator to be removable for maintenance replacement.
- j. Shaft
 - 1) Hollow shaft, rigidly connected to the rotor through a connecting rod and grease lubricated, gear type Universal-joint.

- 2) Strength - Able to withstand minimum 1.5 times maximum operating torque and other loads, and of ample strength and stiffness to operate without distortion or vibration which may reduce pump life at normal speeds.
- 3) Shaft Connecting Rod - Design to limit operating angle to 1 degree angular deflection.
- k. Stuffing box and Mechanical Seal
 - 1) Each stuffing box to contain a split lantern ring at least two packing rings in length, at least five packing rings, and split glands at the outboard end.
 - 2) Chesterton Model 442, John Crane Model 37, or "approved equal" items.
 - 3) Gland halves to be interlocked at assembly and held in position by at least two bolts or studs.
 - 4) Provide each box with a 3/4-inch seal water connection at the normal lantern ring position.
- l. Frame Assembly
 - 1) Frame assembly to rigidly support the rotating element with two bearings.
 - 2) Radial pump loads to be carried by the outboard bearing.
 - 3) Provide ample clearance for stuffing box maintenance.
- m. Bearings
 - 1) Provide heavy-duty anti-friction type bearings completely enclosed in an oil-lubricated cast iron cartridge assembly.
 - 2) Bearings to have an AFBMA L₁₀ Life Rating of 100,000 hours at specified operating conditions.
- n. Accessories
 - 1) Provide each pump with lifting eyebolts or lugs; and fittings for properly adding bearing lubricant and seal water.
 - 2) Provide oil lubricated units with constant level oilers or with sight glasses arranged to indicate operating and static oil levels.
- o. Balance
 - 1) Accurately machine impellers, shafts and other rotating parts to be in as nearly perfect rotational balance as practicable.
 - 2) Statically balanced as a unit to ensure freedom from vibration.
 - 3) Excessive vibration will be sufficient cause for rejection of the equipment.
 - 4) Design to avoid resonance at normal operating speeds.
 - 5) Vibration displacement (peak-to-peak), as measured at any point on the machine, must not exceed 5.0 mils.

- 6) At any operating speed, the ratio of rotative speed to the critical speed of a unit or components thereof to be less than 0.8 or more than 1.3.
- p. Electric Motors
 - 1) Drive motors to be totally enclosed fan cooled, rated 460 volt 60 hertz 3 phase, squirrel cage induction type.
 - 2) Motors provided for sludge recirculation pumps to be severe and inverter duty rated.
 - 3) Motors provided for the sludge wasting pumps shall be severe duty rated.
 - 4) Provide each motor with a motor space heater rated 120 volt 60 hertz 3 phase.
- q. Seal Water Stations
 - 1) Provide one complete seal water station for each pump. Each valve station to include
 - (a) Isolation valves
 - (b) Strainers
 - (c) Pressure regulating device (optional)
 - (d) Flow regulating device
 - (e) Flow indicator
 - (f) Seal water flow switch with two normally open contacts closing on increasing flow
 - (g) Pressure gauge or gauges
 - (h) Solenoid valve
 - (i) Flexible connector
 - 2) Pressure and flow set points to be as recommended by the pump SELLER.
 - 3) Water supply pressure to the seal water system should be approximately 80 psig.
5. Sludge Blowdown Valve
 - a. 4-inch diameter eccentric plug valve with pneumatic actuation - open/close service. Valve to be controlled through main control panel.

2.03 ACCESSORIES

A. Reducers

1. Provide one pipe reducer for installation on the suction and discharge piping of each recirculation/wasting pump.
2. Reducers to be constructed of schedule 10 stainless steel with flanged ends.

B. Plug Valves

1. Provide eccentric plug valves for use in the recirculation/wasting piping.

2. Plug valves to be in accordance with the requirements of Section 15224 - Plug Valves.

C. Solenoid Valves

1. Provide solenoid valves for use in the recirculation/wasting pump seal water systems.
2. Solenoid valves to have packless construction without packing box or sliding seal.
3. Valves to be rated for 115 V ac, 60 Hz, 1 phase, 40 C ambient.
4. Enclosure to be NEMA Type 4 with a conduit knockout
5. Valve construction to be as follows
 - a. Type - 2 way, pilot operated
 - b. Body/Bonnet - Brass or bronze
 - c. Trim
 - 1) Seals - Buna-N or Teflon
 - 2) Disc - Buna-N or Teflon
 - 3) Stem - Manufacturer's standard
 - 4) Bonnet Gasket - Manufacturer's standard
 - 5) Spring - Manufacturer's standard
 - d. Provide valves with threaded end connections
 - e. Valves to be suitable for operation at 32 to 104 F
6. Valves to be manufactured by ASCO - "8210 Series".
7. Provide manufacturer's standard protective coating.

D. Flushing Connections

1. Flushing connections to consist of a 1-¼ inch quick disconnect hose coupling and isolation ball valve.

2.04 FABRICATION

A. Shop Assembly

1. Equipment to be shop assembled to the maximum extent possible.

2.05 FINISHES

A. Shop Paint

1. All non-submerged steel surfaces shall be commercial blast cleaned (SSPC-SP6).
2. All submerged steel surfaces shall be near white blast cleaned (SSPC-SP10).
3. All machined surfaces subject to corrosion shall be coated with an easily removable rust preventative compound prior to shipment.

4. Clean, degrease, and pickle items fabricated from stainless steel following fabrication.
 - a. Pickling shall produce a modest etch and shall remove all embedded iron and heat tint.
 - b. Subject pickled surfaces to 24 hour water or a ferroxyl test to detect the presence of residual embedded iron.
 - c. Items with traces of iron detected after pickling shall be re-pickled as required to remove iron traces.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Equipment Installation
 1. Equipment provided under this section will be installed by BUYER's Contractor under a separate contract.
 2. The HRC trains and chemical systems shall be installed under the direction and in strict conformance with ONDEO Degremont's installation instructions and based on approved shop drawings..

3.02 FIELD QUALITY CONTROL

- A. Special Services to BUYER and BUYER's Contractor
 1. Pursuant to Section 01300 - Special Services
- B. Site Tests, Inspection
 1. Special Services to BUYER for Equipment Checkout, Start-up and Testing, Pursuant to Section 01300 - Special Service.

3.03 ADJUSTING

- A. Special Services to BUYER for Starting and Adjusting, Pursuant to Section 01300 - Special Services.

3.04 DEMONSTRATION

- A. Operation and Maintenance Training
 1. Special Services to BUYER for Operation and Maintenance Training, Pursuant to Section 01300 - Special Services.

3.05 PROTECTION

A. Stainless Steel Surfaces

1. Provide adequate protection for stainless steel surfaces, after pickling, to prevent contact with iron or steel objects or surfaces.

END OF SECTION

SECTION 11515

HIGH RATE CLARIFICATION (HRC) SYSTEM EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes - This Section covers high rate clarification system(HRC) equipment. Each HRC system shall be installed in a concrete structure constructed by BUYER's Contractor under a separate contract.
- B. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures Section Includes

1.02 RELATED SECTIONS

- A. Section 11511 - High Rate Clarification (Actiflo[®]) System
- B. Section 11512 - High Rate Clarification (DensaDeg[®]) System

1.03 REFERENCES

- A. American National Standard Institute (ANSI)
 - 1. B16.5 - Cast Iron Flanges and Flanged Fittings Classes 25, 125, and 250
- B. American Standard Testing Materials (ASTM)
 - 1. A36 - Standard Specification for Carbon Structural Steel

1.04 DEFINITIONS

- A. AFBMA - Anti-Friction Bearing Manufacturers Association
- B. BHN - Birnell Harness Number
- C. Microsand - Fine sand used as a ballast to enhance floc formation

1.05 SUBMITTALS

- A. Goods Data
 - 1. Pursuant to Section 01330 - Submittal Procedures
 - 2. Detailed specifications and drawings containing complete piping and flow diagrams of the proposed installation, including dimensions, weights, and complete parts lists.

- Drawing shall show proposed support and anchorage of equipment and appurtenances and equipment relationship to other parts of the work including clearances for installation.
3. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 GOODS.
 4. Mixing Equipment - Flash Mixers and Reactor Turbines and/or Coagulation, Injection and Flocculation
 - a. Number, size, and type of impellers
 - b. Impellers shaft size, material, and number of sections
 - c. Type, specifications, details, input and output speeds, exact gear ratios, and service factor (24 hour continuous service) of gear reducers
 - d. Maximum horsepower requirements
 - e. Ratio of rotative speed to critical speed or shaft
 - f. Details of supporting base
 5. **Reactor Assemblies - inner draft tube, turbine supports, baffle set, and inlet pipe**
 - a. **Shop painting**
 - b. **Structural drawings**
 6. Clarifier/Thickner/Settling/Residuals Scraper Assemblies
 - a. Name of manufacturer
 - b. Type and model
 - c. Torque Rating
 - d. Maximum (breakdown) torque
 - e. Arm Tip Speed
 - f. Shop Painting
 - g. Structural Drawings
 - h. Type, specifications, details, input, and output speeds, exact gear ratios, and service factor (24 hour continuous service) of gear reducers.
 - 1) Description of overload device.
 - 2) Wiring diagram and electrical schematic
 - i. Shop Drawings - Scum Removal Mechanism
 7. Motors
 - a. Name of manufacturer
 - b. Type and model
 - c. Bearings type and lubrication
 - d. Horsepower rating and service factor
 - e. Temperature rating
 - f. Full load rotative speed
 - g. Net weight
 - h. Efficiency at full load, 3/4 load, 1/2 load, and rated conditions
 - i. Full load current
 - j. Locked rotor current
 - k. Shaft diameter

- l. Overall dimensions
8. Coagulant and Polymer Feed Systems
 - a. Name of manufacturer for each component
 - b. Type and model for each component
 - c. Pressure and flow range for each component
 - d. Schematics of complete feed systems
 - e. Name of Pump Manufacturers
 - f. Type and Model Number of each Pump Manufacturer
 - g. Flow Rate, Design Pressure, and HP for each pump
 - h. Materials of construction for each pump
9. Programmable Logic Controller - Submittals shall be in accordance with the provisions of the programmable logic controllers section.
10. Plate Settlers with Supports, Collection Troughs with Supports, Wear Plates for Bottom Center Hoppers, and Scraper Drive Shaft Protectors
 - a. Name of manufacturer/fabricator for each item
 - b. Type and model for each item as applicable
 - c. Materials of construction for each item
 - d. Details of fabrication for each item
 - e. Net weight for each item
 - f. Data on stainless steel cleaning for each item
 - g. Complete dimensions of each item
 - h. Overall dimensions
 - i. Complete supports details
11. Field Tests
 - a. Testing schedule
 - b. Detailed written test procedures for mechanical startup testing, and optimization and process performance testing
 - c. Forms for data collection
 - d. Calculation formulas
 - e. Description of all sample collections, and analyses required
12. Operation and Maintenance manuals.
 - a. Provide a complete operation and maintenance manual for the equipment in accordance with the requirements of Section 01785 - Operation and Maintenance Data.
13. Wiring, control schematics, and control logic for all electrical and control components furnished.
14. List of special tools for each type of equipment furnished, including special tools necessary for adjustment operation, maintenance and disassembly.

B. Shop Drawings

1. Submit five (5) complete sets.
2. Complete control panel layout drawings.

3. Loop wiring diagrams to include:
 - a. Complete wiring system for the HRC System equipment.
 - b. Terminal connection points for equipment and system inputs from outside HRC System equipment.

C. Quality Assurance/Control Submittals

1. Design Data
2. Manufacturers' Instructions - Installation and checkout instructions including lubrication and initial start-up procedures.
3. Manufacturers' Field Reports - Indicate personnel and actual tests and start-up procedures that were performed by manufacturer's representative

D. Closeout Submittals

1. Pursuant to Section 01775 - Closeout Submittals and Procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

1. Shipping, handling, and unloading shall be pursuant to Section 01600 - Goods Requirements.

B. Acceptance at Site

1. Acceptance of Goods at work site to be pursuant to paragraph 8.01, B of Section 00700 - General Conditions.

C. Storage and Protection

1. Goods to be stored in a dry location by BUYER's Contractor responsible for the equipment installation after receipt by BUYER.
 - a. SELLER to provide instructions for proper storage of the goods to BUYER per paragraph 6.02, Section 00700 of the General Conditions.
2. Goods provided to be free of damage.

1.07 PROJECT CONDITIONS

A. Project Environmental Requirements

1. The environmental conditions are those consistent with the treatment of municipal wastewater with the specified process.

1.08 WARRANTY

A. Correction Period

1. Pursuant to Section 00700 - General Conditions.

- B. Special Warranty
 - 1. Per Agreement, Section 00500.

1.09 MAINTENANCE

- A. Extra Materials
 - 1. Spare Parts
 - a. Package spare parts with labels indicating the contents of each package. Label shall include manufacturer's name, equipment name, part nomenclature, part number, address of nearest distributor, and current list price.
 - b. Provide the following spare parts for each HRC treatment train:
 - 1) Mixers
 - (a) Provide one complete set of bearings and seals for each mixer provided
 - 2) Programmable Logic Controller
 - (a) Provide spare parts for the PLC as indicated in Section 13451 - Programmable Logic Controllers.

PART 2 GOODS

2.01 MATERIALS

- A. Flash Mixer and Reactor Turbine and/or Coagulation, Injection, and Flocculation Mixers
 - 1. Steel Plates and Shapes - AISI Type 304 stainless steel in conformance with ASTM A36
 - 2. Shafts - AISI Type 304 stainless steel
 - 3. Impeller and Turbine Assemblies and Couplings - ANSI Type 304L stainless steel
- B. Clarified/Thickener and /or Micros and/Residuals scraper assemblies
 - 1. Collector Mechanism - ANSI Type 304 stainless steel
 - 2. Scum Removal Mechanism - ANSI Type 304 stainless steel
 - 3. Bridge - Alloy 6061-T6 Aluminum
- C. Coagulant and Polymer feed pumps (diaphragm metering pumps)
 - 1. Diaphragm head - PVC
 - 2. Diaphragm - PTFE or hypalon with EPDM backing.
 - 3. All other materials shall be manufacturer's standard and compatible for continuous service with liquid being pumped.
- D. Coagulant and Polymer Systems
 - 1. Skid - AISI Type 304L stainless steel
 - 2. Piping - Schedule 80 PVC

2.02 EQUIPMENT

- A. Mixing Equipment - Flash Mixers and Reactor Turbines and/or Coagulation, Injection and Flocculation
1. Manufacturers: Lightning, Chemineer Mixing Equipment Company, Philadelphia Mixer Corporation, or SEW/Eurodrive.
 2. Drive Units
 - a. Design drive units for the specific requirements of mixer service and shall be suitable for 24 hour a day operation under moderate shock conditions.
 - b. Each drive unit to consist of a foot-mounted electric motor and a gear reducer, with a flexible coupling provided between the motor and gear reducer.
 - c. Drive units having a pinion mounted directly on the motor shaft will not be acceptable.
 - d. Provide lifting lugs on each motor and gear reducer.
 - e. Provide one set of lifting lugs designed and located to permit lifting of the complete mixer and drive unit.
 - f. Gear reducers to be double or triple reduction type with helical or spiral bevel gearing.
 - g. Worm gearing will not be acceptable.
 - h. Output shaft to be enclosed in a drywell which provides positive leakproof sealing.
 - i. Rigidly couple the output shaft to the mixer shaft.
 - j. Gear reducer and motor bearings to be oil or grease lubricated, rolling element, antifriction type.
 - k. Provide thrust bearings to carry shafting and impeller loads, plus an allowance of at least 25 percent of the weight of the shaft and impeller.
 - l. Bearings located below the bottom of the supporting platform will not be permitted.
 - m. Gear reducers to be selected, designed, and rated in accordance with the appropriate AGMA standards.
 - n. Design gearing with a life factor at least equivalent to 10 million cycles, and an overall service factor of 2.0, based on the sum of the continuous loads plus any transient loads other than starting loads.
 - o. Bearings to have an AFBMA L₁₀ Life Rating of at least 100,000 hours, except output shaft bearings, which shall have an L₁₀ rating of at least 200,000 hours.
 3. Mixer/Turbine Supports
 - a. Design mixer/turbine so that it can be removed from its box as a complete unit after the impeller is removed from the shaft.
 - b. Each mixer shall be assembled on a rigid and substantial base.

- c. The base will be secured to a subbase which will be permanently leveled and grouted in place on the concrete base.
 - d. Provide an opening in the subbase large enough to permit removal of the shaft, including couplings, after removal of the impeller.
 - e. The base and subbase shall be matched and doweled.
 - f. Each mixer to be supported a minimum of 12 inches above the concrete base with adequate access for disassembling the coupling above the concrete base.
4. Impellers and Shafts
- a. Provide each mixer with a turbine impeller of the open type without balancing rings or discs.
 - b. Impellers to be of a design, arrangement, and diameter and operate at a speed that will provide efficient and proper mixing of the applied chemicals and/or Microsand with influent and solids at any rate of flow through the flash mixing chamber, reactor turbine chamber or mixing basin up to the design rate of flow specified herein.
 - c. The rotational speed to be not more than 40 percent of the critical speed of the shaft (including impellers and appurtenances).
 - d. Bottom steady bearings will not be acceptable.
 - e. The location of the impellers above the bottom of the flash mixing chamber, reactor turbine chamber or mixing basin to be as recommended by the mixer manufacturer, and be acceptable to the PROJECT MANAGER.
 - f. Vertical shafting for the impeller assembly to be of ample size and design for the service intended and be supported and steadied so that the unit will operate without shaft whip or vibration.
 - g. Shafts to be of the solid type, except that stainless steel sheathed shafts will be acceptable.
 - h. Provide rigid type couplings fabricated from stainless steel.
 - i. Each impeller shaft (exclusive of shafting in the gear reducer) to be constructed preferably in one section, but in no case more than two sections, as determined by the manufacturer.
 - j. If furnished in two sections, provide suitable rigid shaft coupling.
5. Motors
- a. Motors shall be inverter duty rated, totally enclosed fan cooled, squirrel cage induction type, rated for 460 volt 60 hertz three phase.
 - b. Furnish each motor with motor space heaters rated 120 volt 60 hertz single phase.
 - c. Rated for variable speed operating over the speed range required for the equipment furnished, and in addition, rated for continuous operation at any single speed within the speed range required for the equipment furnished at 40 degrees C ambient.

- d. Motors to be specifically selected for service with an adjustable frequency drive controller, and be derated as required to compensate for harmonic heating effects and reduced self-cooling capability at low speed operation.
 - e. Motors must not exceed a Class B temperature rise when operating in the installed condition at load with power received from the adjustable frequency drive.
 - f. Supply motors with full phase insulation on the end turns per NEMA MG 1 Part 31.
 - g. In addition to the requirements of NEMA MG 1 Part 31, design motors to be continually pulsed at the motor terminals with a voltage of 1600 volts ac.
 - h. Furnish motors with one automatic reset winding temperature switch per phase.
 - i. Temperature switch contacts to be normally closed and shall be rated 120 volts ac.
 - j. Wire switch contacts in series with the end leads brought out to the motor terminal box.
 - k. Switches to be as recommended by the motor manufacturer.
6. **Reactor**
- a. **Inner draft tube sized to promote recirculation and flocculation.**
 - b. **Draft tube to be manufactured from 304 stainless steel. Baffles and all mounting and connection hardware, to be 304 stainless steel.**
 - c. **42-inch 304 stainless steel transfer pipe shall be provided and installed by the BUYER's Contractor.**

B. Clarifier/Thickener/Settling/Residuals Scraper Assemblies - Equipment

- 1. Components
 - a. Torque tube with collector arms. Fabricate torque tube from Sch 80, 304 stainless steel pipe. A center scraper shall extend below the torque tube and into the sludge hopper.
 - b. Effluent trough and external sludge recycle nozzle.
 - c. Adjustable sludge draw-off system provided for the sludge recirculation system.
 - d. Clarification area consists of a section of 2'-0" high (minimum) removable lameller tubes.
 - e. Effluent collection launders shall be rectangular or V-notched weirs.
 - f. **Scum removal systems consisting of slotted Sch. 80, 304 stainless steel pipe with hand lever and wall fittings.**
- 2. Provide residuals scraper assembly for transferring settled floc particles in each sedimentation basin to the bottom center hopper.
- 3. Each scraper mechanism to be suitable for installation in the sedimentation basin and supported on a concrete walkway or structural steel platform.
- 4. The total load of each scraper mechanism is to be supported from the walkway or platform spanning the top of the sedimentation basin.

5. Each scraper to be comprised of a complete assembly including center drive assembly, overload alarm, torque tube, residuals collector arms and necessary anchorage parts.
6. Structural Design:
 - a. The ratio of unbraced length to least radius of gyration (slenderness ratio) not exceed 100 for any compression member and 200 for any tension member (for angles about the Z-Z axis).
 - b. The ratio of span length to depth for supporting beams and trusses not exceed 20 for simple span, or 10 for cantilever span.
 - c. Design structural members and connections so that the unit stresses will not exceed AISC allowable stresses by more than 1/3 when subject to loading of the maximum (breakdown) torque of the drive motor.
 - d. Avoid inaccessible welds and welding of angles back-to-back.
 - e. Do not fabricate submerged carbon steel components from sections with a hollow cross-section, such as pipe or tubular sections; use bars, plates, angles, channels, and other rolled sections.
7. Design Requirements
 - a. Design each overall mechanism for a torque capacity determined when the full volume of sludge and/or sand in the system is collected at the bottom of the clarifier/settler.
 - b. Design each collector arm truss, torque cage, and drive mechanism to withstand the specific minimum rated torque.
 - c. In addition to the specified torque, design structural members and connections to withstand a nonoperating vertical live load of 500 pounds at the outer end of either truss arm.
 - d. The 500 pound load is for structural design only, and is not a condition which must be met during operation.
 - e. The rated torque of components of each collector drive unit to equal or exceed the torque equivalent to the nameplate horsepower of the drive motors.
 - f. Torque measurements to be taken from the center line of the equipment.
 - g. Loading to develop the torque to be considered as uniform loads applied simultaneously at panel points on both arms.
8. Noise Level
 - a. Design and construct motor driven components so that the maximum noise level measured at 3 feet from the installed equipment drives and motors does not exceed 80 dBA.
9. Drive Units
 - a. Each drive unit to be designed and rated to develop the following torque values:
 - 1) Continuous Operating Torque - 27,000 ft/lbs **[Brian - you listed "at an output speed of 0.07 rpm"?]**
 - 2) Cut-out Torque - 33,000 ft/lbs

- b. Each motor to be totally enclosed fan cooled, squirrel cage induction type, rated 460 volt 60 hertz three phase.
 - c. Furnish each motor with a motor space heater rated 120 volt 60 hertz single phase.
 - d. Drive motors to be specifically selected for service with an adjustable frequency drive controller.
 - e. Connect each input speed reducer directly to the drive motor.
 - f. Nominal input horsepower rating of each gear or speed reducer to be no less than nameplate horsepower of the drive motor.
 - g. Each drive unit to be anchored to the turntable base.
 - h. Each drive unit to consist of an electric motor, staged speed reduction units, and an enclosed final speed reduction unit consisting of a pinion and spur gear.
 - i. Drive units with a pinion mounted directly on the motor shaft will not be acceptable.
 - j. BUYER's Contractor to furnish and install VFD in MCCs.
10. Gear Reducers
- a. Each gear reducer to be a totally enclosed unit with oil or grease lubricated, rolling element, anti-friction bearings throughout.
 - b. Gear reducers to have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor.
 - c. Cycloidal gear reducers to have a service factor of at least 2.0 based on the nameplate horsepower of the drive motor.
 - d. Shaft and flange-mounted gear reducers to be rated AGMA Class II.
 - e. Thermal horsepower rating of each unit to equal or exceed the nameplate horsepower of the drive motor.
 - f. During continuous operation, the maximum sump oil temperature must not rise more than 100°F above the ambient air temperature in the vicinity of the unit and must not exceed 200°F.
 - g. Grease lubricated bearing to be installed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun.
 - h. The use of permanently sealed, grease lubricated bearings will not be acceptable.
 - i. Provide an internal or external oil pump and appurtenances if required to properly lubricate oil lubricated bearings.
 - j. Provide a dipstick or a sight glass arranged to permit visual inspection of lubricant level.
11. Lubrication
- a. Equipment to be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation.
 - b. The use of synthetic lubricants will not be acceptable.
 - c. Splash lubrication will not be acceptable.
 - d. Lubrication system to include readily accessible oil fill and drain plugs or grease fittings that do not require the removal of parts or dismantling of equipment.

- e. Permanently sealed or lifetime lubricated bearings will not be acceptable.
 - f. Oil drain and fill openings to be easily accessible from the operating platform and convenient for collection of oil in 18 inch high containers from the platform, without removing the unit or equipment platform from its normal installed position.
12. Safety Guards
- a. Belt or chain drives, fan blades, couplings, and other moving or rotating parts to be covered by a safety guard.
 - b. Safety guards to be fabricated from 16 USS gage thick or thicker galvanized or aluminum-clad sheet steel or from ½ inch mesh galvanized expanded metal.
 - c. Guards to be designed for easy installation and removal.
 - d. Provide galvanized necessary supports and accessories for each guard.
13. Center Drive Mechanism
- a. Center drive mechanisms to consist of a drive unit and gearing.
 - b. Turntable ball races to be four point contact precision type, heat-treated to a minimum 250-300 BHN, and hardened to at least Rockwell C60 or be provided with renewable hard steel liner strips.
 - c. The balls to run in an oil bath, be separated by nylon spacers, and be protected by a felt seal and dust shield.
 - d. Provide a forged steel ring gear on each turntable, heat-treated to minimum 250-300 BHN, and hardened to at least Rockwell C55.
 - 1) Design so that the balls can be replaced by access from the walkway.
 - e. Main bearings to have an AFBMA L₁₀ life rating of at least 200,000 hours and be designed to carry vertical and torque loads plus an additional allowance of 25 percent of the weight of the rotating equipment.
 - f. The main gear to be hardened forged alloy steel.
 - g. Bearings and races to be grease lubricated and protected by suitable seals to prevent contamination from external sources or the main gear oil bath.
 - h. The main gear pinion housing to be fabricate welded steel construction and be completely weatherproof.
14. Overload Mechanism
- a. Provide the drive for each rotating scraper assembly with an indicating torque overload mechanism with a weatherproof, NEMA 4X epoxy coated cast aluminum enclosure and two independently adjustable, electrically isolated contacts.
 - b. The “Alarm” contact to close to operate specified alarm devices when the load reaches approximately 100 percent of the rated torque of the drive unit.
 - c. The “Stop” contact to close to stop the motor at approximately 110 percent of rated torque.
 - d. The overload mechanism to be factory adjusted.
 - e. Torque indication and alarms to be mechanically or electrically actuated.
 - f. Torque overload to be actuated by mechanical methods.

15. Rotating Scraper Assemblies

- a. Scraper mechanisms to consist of two rotating scraper arms, designed to move the solids to the bottom center hopper.
- b. Each arm to be attached to and supported by a center torque tube shaft.
- c. The shaft to be adequate strength and rigidity to support and rotate the scraper arms under maximum load conditions with an adequate factor of safety, and be reinforced at top and bottom for proper distribution of loads to supports.
- d. Fabricate torque tube shaft of schedule 80 type 304 stainless steel pipe.
- e. Fabricate scraper arms from 304 stainless steel members, a minimum of ¼" using triangular or box truss construction.
- f. Trussed arms to be designed so tie rods will not be required.
- g. Provide blades on the scraper arms to move settled residuals to the bottom center hopper.
- h. Evenly space blades on each arm so residuals are collected over the full area of the sedimentation basin by each arm.
- i. Blades to be vertically adjustable, or adjustable edges shall be provided and shall have a minimum depth of 6-inches and a minimum length of 3'-0"
- j. Adjustable neoprene squeegees shall be furnished for all the rake blades and they shall project 1 ½-inches below the bottom of the blades and shall be secured by brass bolts and nuts.
- k. The scraper arms to conform to the slope of the bottom floor.
- l. Fabricate the bottom center hopper scraper of 304 stainless steel and attach directly to the center shaft.

16. Plate Settlers with Supports

- a. Provide on complete set of plate settlers with supports for each settling basin.
- b. Material of construction of the plates to be 316L stainless steel.
- c. Incline of plates to be 60 degrees.
- d. Corrugated plates will not be acceptable.
- e. Plate settlers to be provided with sufficiently supports constructed of 304 stainless steel.
- f. Support angles will be anchored to the sedimentation basin walls as recommended by the manufacturer.
- g. Arrangement of settling modules to ensure flow is divided equally between each module without short circuiting.
- h. Settled solids will slide down the plates and drop into the Microsand/residuals scraper area below.
- i. Plate packs to be factory assembled in a rigid supporting framework constructed of stainless steel structural shapes
 - 1) Frames to be arranged to permit disassembly of the plat packs to facilitate removal and replacement of individual plates.
 - 2) Frames that rack of deform under load will not be acceptable.

17. Collection Troughs with Supports

- a. Provide v-notch or rectangular notch collection troughs with supports to collect clarified water from the sedimentation basins and discharge the clarified water into effluent chambers.
 - b. **Each trough effluent launder shall be complete with 90° v-notch or rectangular notch weir plates on both sides. Weir plates shall be adjustable. [How much?]**
 - c. Each trough shall discharge to a common area in the Clarifier/Thickener basin.
 - d. The system supplier is responsible for determining the number and dimensions of the troughs per basin.
 - e. Troughs shall be of rectangular cross-section.
 - f. **Fabricate the collection troughs from 3/16-inch thick 304 stainless steel or fiberglass reinforced plastic (FRP).**
 - g. Each trough to be shop fabricated and delivered to the site as one continuous unit.
 - h. Field welding to assemble the troughs will not be acceptable.
 - i. Provide suitable lifting lugs on each trough as required for handling and installation.
 - j. Design the troughs to mount into box out openings in the concrete walls at one end of each sedimentation basins.
18. Wear Plates for Bottom Center Hoppers
- a. Provide one wear plate which will be cast into the concrete in each sedimentation basin to protect the concrete from wear.
 - b. Wear plates to be fabricated from 304 stainless steel with angles fabricated from 304 stainless steel for anchoring the plates to the concrete.
 - c. Dimensions, thickness and fabrication details to be as directed by the system supplier.
 - d. Shop fabricate each wear plate with angles.
 - e. Field welding of plates will not be acceptable.
19. Scraper Drive Shaft Protectors
- a. Provide one drive shaft protector with each residual scraper assembly to protect the center drive shaft from the settling plates and to prevent short circuiting of flow around the plate settlers.
 - b. Fabricate drive shaft protectors from 304 stainless steel.
 - c. Dimensions, thicknesses, fabrication details, and mounting details to be as directed by the system supplier.
 - d. Shop fabricate each drive shaft protector and deliver to the site in one complete unit.
 - e. Field welding will not be acceptable.

C. Plate Settlers and Supports

1. Materials:

- a. Plate packs - AISI Type 316L stainless steel
- b. Plate supports - AISI Type 304L stainless steel

D. Chemical and Polymer Feed Systems

1. Coagulant Storage and Feed System
 - a. Manufacturers: Coagulant feed pumps to be manufactured by Sigma.
 - b. Materials:
 - 1) Diaphragm head - PVC
 - 2) Diaphragm - PTFE or hypalon with EPDM backing.
 - 3) Skid - AISI Type 304L stainless steel
 - 4) Piping - Schedule 80 PVC
 - 5) Other materials shall be manufacturer's standard and compatible for continuous service with liquid being pumped.
 - c. Provide one system to feed each train.
 - d. Coagulant system to be capable of storing and automatically feeding ACH or PACL as required to meet the performance requirements.
 - e. Coagulant storage and feed system to consist of the following:
 - 1) Storage tank
 - (i) Storage tank to have a minimum usable capacity of 12,500 gallons.
 - 2) Metering pumps
 - (a) Provide one metering pump capable of feeding coagulant, as required to meet the performance requirements as specified in Section 01112 - Performance Requirements, at a minimum discharge pressure of 65 pig to each feed point.
 - 3) Calibration column
 - 4) Quick connect coupling
2. Polymer System
 - a. Provide one skid mounted system to feed/blend polymer to each train.
 - b. Polymer system to be capable of automatically feeding liquid emulsion polymer as required to meet the performance requirements.
 - c. Polymer feed system to consist of the following:
 - 1) Polymer Feeder/Blender Units
 - (a) Provide a feeder/blender unit for each feed point.
 - (b) Provide a common spare feeder/blender with piping and valving as required to feed to any one of the feed points.
 - 2) Calibration column
 - 3) Secondary dilution water system
 - d. Polymer to be stored in portable chemical totes, to be provided under a separate agreement.
3. Polymer Feeder/Blender
 - a. Manufacturer: Fluid Dynamics or US Filter/Stranco
 - b. Equipment Skid
 - 1) Equipment skid to be sufficiently sized to support polymer equipment.

- 2) Skid to be constructed of stainless steel with a minimum 3/16 inch thick members with flanged sides.
 - 3) Provide skid with a 1 ½ inch high containment lip along the perimeter to prevent accidental spills from running onto floor.
 - 4) Provide a threaded drain connection with a plug at the low point of the skid.
 - 5) Skid to be designed to permit easy access to equipment and maintenance points without requiring the removal of other components.
- c. Feeder/Blender
- 1) Each feeder/blender unit to be capable of automatically metering, diluting, activating, and transferring liquid polymer with water.
 - 2) Each feeder/blender to consist of dilution water system, neat polymer pump, blender, controller, flow meter and associated valves, piping, piping components necessary for a complete system
 - 3) Dilution Water System
 - (a) Provide a manual rate set valve for on/off control of water flow and an electrically operated valve for modulating control of dilution water.
 - (b) Dilution water control components and piping to include strainers, pressure switches, temperature gauges, pressure gauges, rotameters, and other components necessary for a complete system. Pressure switches shall not allow the system to operate with inadequate water supply pressure.
 - (c) Each system shall have two flow meters to measure primary and secondary dilution water flow into the feeder/blender. The flow range of each meter shall be such that the normal flow rate is at the approximate midpoint of the range.
 - (d) Provide pressure gauges on the dilution water supply and mixing chamber.
 - 4) Neat Polymer Transfer Pump
 - (a) Provide one neat polymer transfer pump on each skid to transfer neat polymer with a specific gravity of 1.02 and a maximum viscosity of 3000 cPs from the storage totes (by others) to the activation chamber.
 - (b) Each pump to include continuous local and remote electric and local manual mechanically controlled metering of solution under conditions as required to meet the performance of the HRC system.
 - (c) Pump to be of the electronic solenoid pulse diaphragm type, consisting of a simplex pump head and ball check valves on the inlet and outlet.
 - (d) Pump drive power supply to be rated 120 volts, single phase, 60 Hz.
 - (e) Pump to be manually adjustable by two separate dial knobs, one for adjusting stroke length and the other for adjusting stroke frequency.
 - (f) Provide each pump with an automatic/manual switch which when in automatic, will allow the pump to be remotely adjusted through

- adjustment of the stroke frequency via a 24 volt DC signal from the polymer system control panel.
- (g) Materials of construction to be selected for compatibility with polymer.
 - (h) Provide each pump with the following accessories
 - (1) One CPVC duplex basket strainer mounted on the pump suction with socket end connections.
 - (2) One pressure gauge with isolating diaphragm installed in the pump discharge piping.
- 5) Blender Unit
- (a) Polymer activation may be accomplished by either a hydrodynamic blending device or a motor driven activation device.
 - (b) Hydrodynamic Blending Device
 - (1) Device to be cylindrical, non-mechanical specifically designed to dilute and activate polymer.
 - (2) The activation chamber's mixing energy to be staged such that it provides for high, non-damaging mixing energy over the full operating range of the system.
 - (3) Design of chamber shall not expose polymer to excessive shear under any operating rate within the full range of the system.
 - (c) Motor Driven Activation Device
 - (1) Device to be a horizontally mounted activation chamber consisting of a rotor and stationary sleeve, each constructed of polymer-resistant synthetic materials.
 - (2) The rotor shall generate a turbulent blending action within a number of horizontal cylindrical chambers internal to the rotor.
 - (3) Polymer shall exit from the chambers through a series of radial openings and pass through a controlled shear zone at the interface of the rotor into the stationary sleeve.
 - (4) Impeller speed not to exceed 3,450 rpm.
 - (5) Motor to be of the TEFC type rated 460 volts, three phase, 60 Hz, and shall be direct coupled to the impeller shaft.
- 6) Controller
- (a) Each unit to be provided with a single control panel to house controls for local manual and automatic control of the feeder/blender.
 - (b) Provide a single NEMA 4X enclosure.
 - (c) The control system shall provide for automatic adjustment of the polymer and dilution water feed rates to provide the polymer concentration selected and to match the required feed rates as input from the HRC control system.
 - (d) The control panel shall include operating and alarm indicating lights as required to monitor and troubleshoot the system.

- (e) Provide isolated contact outputs rated a minimum of 5 amperes at 120 volts ac which close to indicate running, loss of water, and system in auto.
- 7) Flow Meters
 - (a) Provide one flow meter in the discharge piping from the neat polymer pump.
 - (b) Flow meters to provide local indication of instantaneous flow rate in gallons per hour and totalized flow in gallons.
 - (c) Wetted parts to be constructed on materials compatible with polymer and shall be rated to withstand the maximum pressure output from the pump.
- 4. Storage Tanks
 - a. Storage tanks to be flat bottom vertical cylindrical tank with flat flange top.
 - b. Tanks to be constructed of Fiberglass Reinforced Plastic (FRP) with resins compatible with the chemicals stored.
 - c. Provide each storage tanks with the following accessories:
 - 1) Provide a minimum of one side and one top access manway
 - (a) Manway to be minimum 22 inches with flanged connection and fabricated blind flange of the same materials as the tank.
 - (b) Flange diameter and drilling to be in accordance with ANSI B15.5, class 150
 - 2) Flanged piping connections for vent, overflow, fill, drain, discharge, sight level gauge, ultrasonic level gauge connections.
 - 3) Ladder and top handrail meeting applicable OSHA requirements.
 - 4) Clear plastic sight level gauge constructed of clear PVC or borosilicate glass.
 - 5) Level gauge to be provided with:
 - (a) Isolation ball valves
 - (b) Gauge drain valve
- 5. Metering Pumps
 - a. Pumps to be simplex, motor-driven, reciprocating, mechanically actuated diaphragm type.
 - b. Pumps to include integral motor, oil lubricated gear reducer, cam-and-spring drive mounted in an aluminum housing with plastic corrosion protection.
 - c. Liquid end to be separated from the drive end by a back plate with air gap and weep hole.
 - d. Diaphragms to be nylon reinforced EPDM with PTFE-faced fluid contact surface.
 - e. Pump turndown to be 100:1; 10:1 stroke length by manually adjustment; 10:1 speed adjustment.
 - 1) Stroke adjustment to be in increments of 1%, from 0% to 100%.
 - 2) Speed adjustment to be controlled by DC SCR drive system
 - f. Liquid end to be fully compatible with the chemical being pumped.
 - g. Power supply to the pumps to be 115 VAC, 60 Hz, 1 phase.

- h. Each pump to be provided with the following accessories:
 - 1) One Y-pattern strainer with 8-mesh screen and O-ring seals.
 - 2) Two properly sized diaphragm type pulsation dampeners for installation in the suction and discharge piping of each pump.
 - (a) Pulsation dampeners to be constructed of materials compatible with pumped chemicals
 - (b) Each pulsation dampener to include air valve and pressure gauge
 - 3) One pressure gauge with isolation dampener to be installed in the discharge piping of each pump.
 - (a) Pressure gauges to be in accordance with Section 13420 - Instruments.
 - 4) One external pressure relief valve sized to pass the maximum displacement of the pump
 - 5) One backpressure valve.
- 6. Calibration Column
 - a. Provide one transparent clear plastic calibrating column to be installed in the pump suction piping.
 - b. Column to be minimum 1-inch ID clear PVC or other resistant, rigid, transparent plastic tubing having a vented top cap.
 - c. Column to be graduated in 0.005 gallon and 20 milliliter increments over a range of 0 to 0.08 gallons/303 milliliters.
 - d. Columns to be by Valcom, Inc. "Model 8500", or "approved equal" items.
- 7. Quick Connect Coupling
 - a. Provide one quick connect coupling for transport truck unloading connection to the coagulant storage tank.
 - b. Materials of construction to be compatible with the chemical in the storage tank.
 - c. Quick connect couplings to be standard cam and groove type manufactured to specification MIL-C-27487.
 - d. Provide one lockable dust cap with each coupling.
- 8. Secondary Dilution Water System
 - e. Provide a complete secondary polymer dilution water system for each polymer feed point
 - f. Secondary dilution water system to include the following
 - 1) PVC piping and PVC fittings
 - 2) Check valves
 - 3) Rotameters
 - 4) Flow regulators
 - 5) Solenoid valves
 - 6) Isolation ball valves
 - g. System components to be sized to provide the necessary secondary dilution water as recommended by the manufacturer with a water supply pressure of 65 pig.

2.03 CONTROLS AND INSTRUMENTATION

- A. The SELLER's system shall have the capability to communicate and be controlled by a Foxboro I/A supervisory system located at the Peak Excess Flow Treatment Facility. It is the BUYER's preference to utilize the Foxboro I/A system, integrating the SELLER's controls. All programming and communications needed to allow the Foxboro I/A supervisory system to control the SELLER's equipment shall be provided by the SELLER.
- B. Alternatively, the SELLER may provide a control system utilizing a Programmable Logic Controller with operator interface touchscreen. The programming must have an open protocol so that the Foxboro I/A supervisory system can maintain full control of the SELLER's equipment. All programming and communications needed to allow the Foxboro I/A supervisory system to control the SELLER's equipment shall be provided by the SELLER.
- C. In addition to the above, provide the following items as part of an integrated control system for controlling each train.
 - 1. One main control panel
 - 2. Ultrasonic level sensors
 - 3. Sludge blanket detectors
 - 4. Magnetic flow meters
 - 5. pH analyzers
 - 6. Turbidity meters
 - 7. Pressure switches
 - 8. pH meters
 - 9. Pressure gauges with diaphragm seals
 - 10. Isolation rings/annular seals for pressure instruments
 - 11. Spare I/O
- D. Instrumentation to be in accordance with the requirements of specification section 13420 - Instruments.
- E. Programmable Logic Controller
 - 1. Provide one programmable logic controller based control panel to operate, control, and monitor the HRC system, including flash mixers, reactor turbines, scraper motor drives, sludge recirculation and wasting pumps, Microsand/residuals recirculation, polymer and coagulant feed systems of the trains, and associated equipment.
 - 2. PLC's to have sufficient capacity to allow for control of equipment for up to four (4) additional trains to be added in future expansions of the facility.
 - 3. Provide one Operator Interface Touchscreen accessible from the front cover of the control panel.
 - 4. Programmable logic controllers and OIT's to be in accordance with the requirements of specification section 13451 - Programmable Logic Controllers.

5. All PLC code shall be included in the O&M manual including printed out and fully annotated ladder logic diagrams.

F. Main Control Panel

1. Furnish one (1) control panel to be located indoors, serving the HRC systems. Provide the following:
 - a. Local panel containing programmable logic controller, contacts, power disconnects, terminal blocks, timers, relays, transformers, pushbuttons, hand switches, status lights, and wiring to operate each train.
 - b. Provide controls necessary to allow all pumps and drives to operate in either local or remote modes.
 - c. Provide required I/O points for control, operation, and monitoring of each train installed, plus up to four (4) additional future units.
2. Control panel to be in accordance with the requirements of Section 13451 - PLCs.
3. Control panel shall be completely assembled, tested, and programmed prior to shipment to the site.

G. Local Control Stations

1. Provide local control stations at each drive consisting of a Hand-Off-Auto switch and start/stop pushbuttons, run light and fail light.

- H. Variable Speed Drives (VFDs) shall be furnished by the BUYER's Contractor and installed in the motor control centers. The BUYER's Contractor shall coordinate with SELLER on VFD and motor starter sizing requirements. SELLER shall submit in writing a letter stating the control options, rating and size information on the electrical equipment have been verified to work with the equipment being supplied. Other systems that provide a functional equivalent will be considered.

2.04 FABRICATION

A. Shop Assembly

1. Equipment to be shop assembled to the maximum extent possible.

2.05 FINISHES

A. Shop Priming, Shop Finishing

1. All non-submerged steel surfaces shall be commercial blast cleaned (SSPC-SP6).
2. All submerged steel surfaces shall be near white blast cleaned (SSPC-SP10).
3. Clarifier center drive and motor, flash mixer gear drive and motor, turbine gear drive and motor, and/or mixer and Microsand/residuals scraper drives and motors and all

steel components shall receive one (1) coat of Tnemec 91-H20-Hydro-Zinc with a minimum 3 to 5 mils DFT.

4. Machined surfaces subject to corrosion shall be coated with an easily removable rust preventative compound prior to shipment.
5. The turbine gear drive shall be provided with the manufacturer's standard severe duty finish.
6. Clean, degrease, and pickle items fabricated from stainless steel following fabrication.
 - a. Pickling shall produce a modest etch and shall remove all embedded iron and heat tint.
 - b. Subject pickled surfaces to 24 hour water or a ferroxyl test to detect the presence of residual embedded iron.
 - c. Items with traces of iron detected after pickling shall be re-pickled as required to remove iron traces.

B. Field Painting (By BUYER's Contractor)

1. Field painting shall be the responsibility of the BUYER's Contractor.

PART 3 EXECUTION

3.01 INSTALLERS - NOT USED

A. Equipment Installation

1. Equipment provided under this section will be installed by BUYER's Contractor under a separate contract.
2. The HRC system equipment shall be installed under the direction and in strict conformance with SELLER's installation instructions and based on approved shop drawings.

3.02 FIELD QUALITY CONTROL

A. Special Services to BUYER and BUYER's Contractor

1. Pursuant to Section 01300 - Special Services

B. Site Tests, Inspection

1. Special Services to BUYER for Equipment Checkout, Start-up and Testing, Pursuant to Section 01300 - Special Service.

3.03 ADJUSTING

- A. Special Services to BUYER for Starting and Adjusting, Pursuant to Section 01300 - Special Services.

3.04 DEMONSTRATION

A. Operation and Maintenance Training

1. Special Services to BUYER for Operation and Maintenance Training, Pursuant to Section 01300 - Special Services.

3.05 PROTECTION

A. Stainless Steel Surfaces

1. Protect stainless steel surfaces, after pickling, to prevent contact with iron or steel objects or surfaces.

END OF SECTION

SECTION 11515

HIGH RATE CLARIFICATION (HRC) SYSTEM EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes - This Section covers high rate clarification system(HRC) equipment. Each HRC system shall be installed in a concrete structure constructed by BUYER's Contractor under a separate contract.
- B. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures Section Includes

1.02 RELATED SECTIONS

- A. Section 11511 - High Rate Clarification (Actiflo[®]) System
- B. Section 11512 - High Rate Clarification (DensaDeg[®]) System

1.03 REFERENCES

- A. American National Standard Institute (ANSI)
 - 1. B16.5 - Cast Iron Flanges and Flanged Fittings Classes 25, 125, and 250
- B. American Standard Testing Materials (ASTM)
 - 1. A36 - Standard Specification for Carbon Structural Steel

1.04 DEFINITIONS

- A. AFBMA - Anti-Friction Bearing Manufacturers Association
- B. BHN - Birnell Harness Number
- C. Start-up time - The elapsed time between the moment when treated wastewater is first discharged from the outlet of the HRC process, and the moment that the quality of the discharged wastewater begins to consistently meet the guaranteed performance requirements.

1.05 SUBMITTALS

- A. Goods Data

1. Pursuant to Section 01330 - Submittal Procedures
2. Detailed specifications and drawings containing complete piping and flow diagrams of the proposed installation, including dimensions, weights, and complete parts lists. Drawing shall show proposed support and anchorage of equipment and appurtenances and equipment relationship to other parts of the work including clearances for installation.
3. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 GOODS.
4. Mixing Equipment - Flash Mixers and Reactor Turbines and/or Coagulation, Injection and Flocculation
 - a. Number, size, and type of impellers
 - b. Impellers shaft size, material, and number of sections
 - c. Type, specifications, details, input and output speeds, exact gear ratios, and service factor (24 hour continuous service) of gear reducers
 - d. Maximum horsepower requirements
 - e. Ratio of rotative speed to critical speed or shaft
 - f. Details of supporting base
5. Reactor Assemblies - inner draft tube, turbine supports, baffle set, and inlet pipe
 - a. Shop painting
 - b. Structural drawings
6. Clarifier/Thickener/Settling/Residuals Scraper Assemblies
 - a. Name of manufacturer
 - b. Type and model
 - c. Torque Rating
 - d. Maximum (breakaway) torque
 - e. Arm Tip Speed
 - f. Shop Painting
 - g. Structural Drawings
 - h. Type, specifications, details, input, and output speeds, exact gear ratios, and service factor (24 hour continuous service) of gear reducers.
 - 1) Description of overload device.
 - 2) Wiring diagram and electrical schematic
 - i. Shop Drawings - Scum Removal Mechanism (if required)
7. Motors
 - a. Name of manufacturer
 - b. Type and model
 - c. Bearings type and lubrication
 - d. Horsepower rating and service factor
 - e. Temperature rating
 - f. Full load rotative speed
 - g. Net weight
 - h. Efficiency at full load, 3/4 load, 1/2 load, and rated conditions

- i. Full load current
 - j. Locked rotor current
 - k. Shaft diameter
 - l. Overall dimensions
8. Coagulant and Polymer Feed Systems
 - a. Name of manufacturer for each component
 - b. Type and model for each component
 - c. Pressure and flow range for each component
 - d. Schematics of complete feed systems
 - e. Name of Pump Manufacturers
 - f. Type and Model Number of each Pump Manufacturer
 - g. Flow Rate, Design Pressure, and HP for each pump
 - h. Materials of construction for each pump
 9. Programmable Logic Controller - Submittals shall be in accordance with the provisions of the programmable logic controllers section.
 10. Plate Settlers with Supports, Collection Troughs with Supports, Wear Plates for Bottom Center Hoppers, and Scraper Drive Shaft Protectors
 - a. Name of manufacturer/fabricator for each item
 - b. Type and model for each item as applicable
 - c. Materials of construction for each item
 - d. Details of fabrication for each item
 - e. Net weight for each item
 - f. Data on stainless steel cleaning for each item
 - g. Complete dimensions of each item
 - h. Overall dimensions
 - i. Complete supports details
 11. Field Tests
 - a. Testing schedule
 - b. Detailed written test procedures for mechanical startup testing, and optimization and process performance testing
 - c. Forms for data collection
 - d. Calculation formulas
 - e. Description of all sample collections, and analyses required
 12. Operation and Maintenance manuals.
 - a. Provide a complete operation and maintenance manual for the equipment in accordance with the requirements of Section 01785 - Operation and Maintenance Data.
 13. Wiring, control schematics, and control logic for all electrical and control components furnished.
 14. List of special tools for each type of equipment furnished, including special tools necessary for adjustment operation, maintenance and disassembly.
 15. Programming Coordination

- a. Database, PLC register, or other data needed by the HRC system PLC (i.e. operator input, run status, etc.)
 - b. Database, PLC register, or other data output from the HRC system (i.e. alarm, system running, etc.)
 - c. Operator interface screen requirements needed to monitor and control the system from the Plant Control System.
 - d. Main Control Panel
 - 1) Submittals to be in accordance with the provisions of the Programmable Logic Controller Section 13451.
- B. Shop Drawings
 - 1. Submit five (5) complete sets.
 - 2. Complete control panel layout drawings.
 - 3. Loop wiring diagrams to include:
 - a. Complete wiring system for the HRC System equipment.
 - b. Terminal connection points for equipment and system inputs from outside HRC System equipment.
- C. Quality Assurance/Control Submittals
 - 1. Design Data
 - 2. Manufacturers' Instructions - Installation and checkout instructions including lubrication and initial start-up procedures.
 - 3. Manufacturers' Field Reports - Indicate personnel and actual tests and start-up procedures that were performed by manufacturer's representative.
- D. Closeout Submittals
 - 1. Pursuant to Section 01775 - Closeout Submittals and Procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading
 - 1. Shipping, handling, and unloading shall be pursuant to Section 01600 - Goods Requirements.
- B. Acceptance at Site
 - 1. Acceptance of Goods at work site to be pursuant to paragraph 8.01, B of Section 00700 - General Conditions.
- C. Storage and Protection
 - 1. Goods to be stored in a dry location by BUYER's Contractor responsible for the equipment installation after receipt by BUYER.

- a. SELLER to provide instructions for proper storage of the goods to BUYER per paragraph 6.02, Section 00700 of the General Conditions.
2. Goods provided to be free of damage.

1.07 PROJECT CONDITIONS

- A. Project Environmental Requirements
 1. The environmental conditions are those consistent with the treatment of municipal wastewater with the specified process.

1.08 WARRANTY

- A. Correction Period
 1. Pursuant to Section 00700 - General Conditions.
- B. Special Warranty
 1. Per Agreement, Section 00500.

1.09 MAINTENANCE

- A. Extra Materials
 1. Spare Parts
 - a. Package spare parts with labels indicating the contents of each package. Label shall include manufacturer's name, equipment name, part nomenclature, part number, address of nearest distributor, and current list price.
 - b. Provide the following spare parts for each HRC treatment train:
 - 1) Mixers
 - (i) Provide one complete set of bearings and seals for each mixer provided
 - 2) Programmable Logic Controller
 - (i) Provide spare parts for the PLC as indicated in Section 13451 - Programmable Logic Controllers.

1.10 SYSTEM START UP, COMMISSIONING, AND BUYERS TRAINING

- A. System Start-up
 1. SELLER to assist the BUYER and the BUYER's Contractor installing the equipment as indicated in Section 01750 - Starting and Adjusting.
- B. Commissioning
 1. SELLER to provide materials and special services during facility Commissioning as indicated in Section 01810 - Commissioning.

C. BUYER's Training

1. SELLER to provide the materials and special services to demonstrate operation of the HRC system and for training of BUYER's staff as indicated in Section 01820 - Demonstration and Training.

1.11 DESIGN SUPPORT SERVICES

- A. SELLER to provide process and design engineering support services as indicated in Section 01300 - Special Services.

PART 2 GOODS

2.01 MATERIALS

- A. Flash Mixer and Reactor Turbine and/or Coagulation, Injection, and Flocculation Mixers
1. Steel Plates and Shapes - AISI Type 304 stainless steel in conformance with ASTM A36
 2. Shafts - AISI Type 304 stainless steel
 3. Impeller and Turbine Assemblies and Couplings - AISI Type 304L stainless steel
- B. Clarifier/Thickener and /or Microsand/Residuals scraper assemblies
1. Collector Mechanism - AISI Type 304 stainless steel
 2. Scum Removal Mechanism - AISI Type 304 stainless steel
- C. Coagulant and Polymer feed pumps (diaphragm metering pumps)
1. Diaphragm head - PVC
 2. Diaphragm - PTFE or hypalon with EPDM backing.
 3. All other materials shall be manufacturer's standard and compatible for continuous service with liquid being pumped.
- D. Coagulant and Polymer Systems
1. Skid - AISI Type 304L stainless steel
 2. Piping - Schedule 80 PVC
- E. Plate Settlers and Supports
1. Plate packs - AISI Type 316L stainless steel
 2. Plate supports - AISI Type 304L stainless steel

2.02 EQUIPMENT

- A. Mixing Equipment - Flash Mixers and/or Reactor Turbines and/or Coagulation, Injection and Flocculation
1. Manufacturers: Lightning, Chemineer Mixing Equipment Company, Philadelphia Mixer Corporation, or SEW/Eurodrive.
 2. Drive Units
 - a. Design drive units for the specific requirements of mixer service and shall be suitable for 24 hour a day operation under moderate shock conditions.
 - b. Each drive unit to consist of a foot-mounted electric motor and a gear reducer, with a flexible coupling provided between the motor and gear reducer.
 - c. Drive units having a pinion mounted directly on the motor shaft will not be acceptable.
 - d. Provide lifting lugs on each motor and gear reducer.
 - e. Provide one set of lifting lugs designed and located to permit lifting of the complete mixer and drive unit.
 - f. Gear reducers to be double or triple reduction type with helical or spiral bevel gearing.
 - g. Worm gearing will not be acceptable.
 - h. Output shaft to be enclosed in a drywell which provides positive leakproof sealing.
 - i. Rigidly couple the output shaft to the mixer shaft.
 - j. Gear reducer and motor bearings to be oil or grease lubricated, rolling element, antifriction type.
 - k. Provide thrust bearings to carry shafting and impeller loads, plus an allowance of at least 25 percent of the weight of the shaft and impeller.
 - l. Bearings located below the bottom of the supporting platform will not be permitted.
 - m. Gear reducers to be selected, designed, and rated in accordance with the appropriate AGMA standards.
 - n. Design gearing with a life factor at least equivalent to 10 million cycles, and an overall service factor of 2.0, based on the sum of the continuous loads plus any transient loads other than starting loads.
 - o. Bearings to have an AFBMA L₁₀ Life Rating of at least 100,000 hours, except output shaft bearings, which shall have an L₁₀ rating of at least 200,000 hours.
 3. Mixer/Turbine Supports
 - a. Design mixer/turbine so that it can be removed from its box as a complete unit after the impeller is removed from the shaft.
 - b. Each mixer shall be assembled on a rigid and substantial base.
 - c. The base will be secured to a subbase which will be permanently leveled and grouted in place on the concrete base.
 - d. Provide an opening in the subbase large enough to permit removal of the shaft, including couplings, after removal of the impeller.
 - e. The base and subbase shall be matched and doweled.

- f. Each mixer to be supported a minimum of 12 inches above the concrete base with adequate access for disassembling the coupling above the concrete base.
- 4. Impellers and Shafts
 - a. Provide each mixer with a turbine impeller of the open type without balancing rings or discs.
 - b. Impellers to be of a design, arrangement, and diameter and operate at a speed that will provide efficient and proper mixing of the applied chemicals and/or Microsand with influent and solids at any rate of flow through the flash mixing chamber, reactor turbine chamber or mixing basin up to the design rate of flow specified herein.
 - c. The rotational speed to be not more than 40 percent of the critical speed of the shaft (including impellers and appurtenances).
 - d. Bottom steady bearings will not be acceptable.
 - e. The location of the impellers above the bottom of the flash mixing chamber, reactor turbine chamber or mixing basin to be as recommended by the mixer manufacturer, and be acceptable to the PROJECT MANAGER.
 - f. Vertical shafting for the impeller assembly to be of ample size and design for the service intended and be supported and steadied so that the unit will operate without shaft whip or vibration.
 - g. Shafts to be of the solid type, except that stainless steel sheathed shafts will be acceptable.
 - h. Provide rigid type couplings fabricated from stainless steel.
 - i. Each impeller shaft (exclusive of shafting in the gear reducer) to be constructed preferably in one section, but in no case more than two sections, as determined by the manufacturer.
 - j. If furnished in two sections, provide suitable rigid shaft coupling.
- 5. Motors
 - a. Motors shall be inverter duty rated, totally enclosed fan cooled, squirrel cage induction type, rated for 460 volt 60 hertz three phase.
 - b. Furnish each motor with motor space heaters rated 120 volt 60 hertz single phase.
 - c. Rated for variable speed operating over the speed range required for the equipment furnished, and in addition, rated for continuous operation at any single speed within the speed range required for the equipment furnished at 40 degrees C ambient.
 - d. Motors to be specifically selected for service with an adjustable frequency drive controller, and be derated as required to compensate for harmonic heating effects and reduced self-cooling capability at low speed operation.
 - e. Motors must not exceed a Class B temperature rise when operating in the installed condition at load with power received from the adjustable frequency drive.

- f. Supply motors with full phase insulation on the end turns per NEMA MG 1 Part 31.
- g. In addition to the requirements of NEMA MG 1 Part 31, design motors to be continually pulsed at the motor terminals with a voltage of 1600 volts ac.
- h. Furnish motors with one automatic reset winding temperature switch per phase.
- i. Temperature switch contacts to be normally closed and shall be rated 120 volts ac.
- j. Wire switch contacts in series with the end leads brought out to the motor terminal box.
- k. Switches to be as recommended by the motor manufacturer.
- 6. Reactor (if required)
 - a. Inner draft tube sized to promote recirculation and flocculation.
 - b. Draft tube to be manufactured from 304 stainless steel. Baffles and all mounting and connection hardware, to be 304 stainless steel.
 - c. 42-inch 304 stainless steel transfer pipe shall be provided and installed by the BUYER's Contractor.

B. Clarifier/Thickener/Settling/Residuals Scraper Assemblies - Equipment

- 1. Components
 - a. Torque tube with collector arms. Fabricate torque tube from Sch 80, 304 stainless steel pipe. A center scraper shall extend below the torque tube and into the sludge hopper.
 - b. Effluent trough and, if required, an external sludge recycle nozzle.
 - c. Clarification area consists of a section of 2'-0" high (minimum) removable lameller tubes.
 - d. Effluent collection launders shall be rectangular or V-notched weirs as recommended by the equipment manufacturer.
 - e. Scum removal systems, if required, shall consist of a slotted Sch. 80, 304 stainless steel pipe with hand lever and wall fittings.
- 2. Provide residuals scraper assembly for transferring settled floc particles in each sedimentation basin to the bottom center hopper.
- 3. Each scraper mechanism to be suitable for installation in the sedimentation basin and supported on a concrete walkway.
- 4. The total load of each scraper mechanism is to be supported from the walkway or platform spanning the top of the sedimentation basin.
- 5. Each scraper to be comprised of a complete assembly including center drive assembly, overload alarm, torque tube, residuals collector arms and necessary anchorage parts.
- 6. Structural Design:

- a. The ratio of unbraced length to least radius of gyration (slenderness ratio) not exceed 100 for any compression member and 200 for any tension member (for angles about the Z-Z axis).
 - b. The ratio of span length to depth for supporting beams and trusses not exceed 20 for simple span, or 10 for cantilever span.
 - c. Design structural members and connections so that the unit stresses will not exceed AISC allowable stresses by more than 1/3 when subject to loading of the maximum (breakdown) torque of the drive motor.
 - d. Avoid inaccessible welds and welding of angles back-to-back.
 - e. Do not fabricate submerged carbon steel components from sections with a hollow cross-section, such as pipe or tubular sections; use bars, plates, angles, channels, and other rolled sections.
7. Design Requirements
- a. Design each overall mechanism for a torque capacity determined when the full volume of sludge and/or sand in the system is collected at the bottom of the clarifier/settler.
 - b. Design each collector arm truss, torque cage, and drive mechanism to withstand the specific minimum rated torque.
 - c. In addition to the specified torque, design structural members and connections to withstand a nonoperating vertical live load of 500 pounds at the outer end of either truss arm.
 - d. The 500 pound load is for structural design only, and is not a condition which must be met during operation.
 - e. The rated torque of components of each collector drive unit to equal or exceed the torque equivalent to the nameplate horsepower of the drive motors.
 - f. Torque measurements to be taken from the center line of the equipment.
 - g. Loading to develop the torque to be considered as uniform loads applied simultaneously at panel points on both arms.
8. Noise Level
- a. Design and construct motor driven components so that the maximum noise level measured at 3 feet from the installed equipment drives and motors does not exceed 80 dBA.
9. Drive Units
- a. Each drive unit to be designed and rated to develop the following torque values:
 - 1) Continuous Operating Torque - 27,000 ft/lbs
 - 2) Cut-out Torque - 33,000 ft/lbs
 - b. Each motor to be totally enclosed fan cooled, squirrel cage induction type, rated 460 volt 60 hertz three phase.
 - c. Furnish each motor with a motor space heater rated 120 volt 60 hertz single phase.
 - d. Drive motors to be specifically selected for service with an adjustable frequency drive controller.

- e. Connect each input speed reducer directly to the drive motor.
 - f. Nominal input horsepower rating of each gear or speed reducer to be no less than nameplate horsepower of the drive motor.
 - g. Each drive unit to be anchored to the turntable base.
 - h. Each drive unit to consist of an electric motor, staged speed reduction units, and an enclosed final speed reduction unit consisting of a pinion and spur gear.
 - i. Drive units with a pinion mounted directly on the motor shaft will not be acceptable.
 - j. BUYER's Contractor to furnish and install VFD in MCCs.
10. Gear Reducers
- a. Each gear reducer to be a totally enclosed unit with oil or grease lubricated, rolling element, anti-friction bearings throughout.
 - b. Gear reducers to have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor.
 - c. Cycloidal gear reducers to have a service factor of at least 2.0 based on the nameplate horsepower of the drive motor.
 - d. Shaft and flange-mounted gear reducers to be rated AGMA Class II.
 - e. Thermal horsepower rating of each unit to equal or exceed the nameplate horsepower of the drive motor.
 - f. During continuous operation, the maximum sump oil temperature must not rise more than 100°F above the ambient air temperature in the vicinity of the unit and must not exceed 200°F.
 - g. Grease lubricated bearing to be installed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun.
 - h. The use of permanently sealed, grease lubricated bearings will not be acceptable.
 - i. Provide an internal or external oil pump and appurtenances if required to properly lubricate oil lubricated bearings.
 - j. Provide a dipstick or a sight glass arranged to permit visual inspection of lubricant level.
11. Lubrication
- a. Equipment to be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation.
 - b. The use of synthetic lubricants will not be acceptable.
 - c. Splash lubrication will not be acceptable.
 - d. Lubrication system to include readily accessible oil fill and drain plugs or grease fittings that do not require the removal of parts or dismantling of equipment.
 - e. Permanently sealed or lifetime lubricated bearings will not be acceptable.
 - f. Oil drain and fill openings to be easily accessible from the operating platform and convenient for collection of oil in 18 inch high containers from the platform, without removing the unit or equipment platform from its normal installed position.
12. Safety Guards

- a. Belt or chain drives, fan blades, couplings, and other moving or rotating parts to be covered by a safety guard.
 - b. Safety guards to be fabricated from 16 USS gage thick or thicker galvanized or aluminum-clad sheet steel or from ½ inch mesh galvanized expanded metal.
 - c. Guards to be designed for easy installation and removal.
 - d. Provide galvanized necessary supports and accessories for each guard.
13. Center Drive Mechanism
- a. Center drive mechanisms to consist of a drive unit and gearing.
 - b. Turntable ball races to be four point contact precision type, heat-treated to a minimum 250-300 BHN, and hardened to at least Rockwell C60 or be provided with renewable hard steel liner strips.
 - c. The balls to run in an oil bath, be separated by nylon spacers, and be protected by a felt seal and dust shield.
 - d. Provide a forged steel ring gear on each turntable, heat-treated to minimum 250-300 BHN, and hardened to at least Rockwell C55.
 - 1) Design so that the balls can be replaced by access from the walkway.
 - e. Main bearings to have an AFBMA L₁₀ life rating of at least 200,000 hours and be designed to carry vertical and torque loads plus an additional allowance of 25 percent of the weight of the rotating equipment.
 - f. The main gear to be hardened forged alloy steel.
 - g. Bearings and races to be grease lubricated and protected by suitable seals to prevent contamination from external sources or the main gear oil bath.
 - h. The main gear pinion housing to be fabricate welded steel construction and be completely weatherproof.
14. Overload Mechanism
- a. Provide the drive for each rotating scraper assembly with an indicating torque overload mechanism with a weatherproof, NEMA 4X epoxy coated cast aluminum enclosure and two independently adjustable, electrically isolated contacts.
 - b. The “Alarm” contact to close to operate specified alarm devices when the load reaches approximately 100 percent of the rated torque of the drive unit.
 - c. The “Stop” contact to close to stop the motor at approximately 110 percent of rated torque.
 - d. The overload mechanism to be factory adjusted.
 - e. Torque indication and alarms to be mechanically or electrically actuated.
 - f. Torque overload to be actuated by mechanical methods.
15. Rotating Scraper Assemblies
- a. Scraper mechanisms to consist of two rotating scraper arms, designed to move the solids to the bottom center hopper.
 - b. Each arm to be attached to and supported by a center torque tube shaft.

- c. The shaft to be adequate strength and rigidity to support and rotate the scraper arms under maximum load conditions with an adequate factor of safety, and be reinforced at top and bottom for proper distribution of loads to supports.
 - d. Fabricate torque tube shaft of schedule 80 type 304 stainless steel pipe.
 - e. Fabricate scraper arms from 304 stainless steel members, a minimum of ¼" using triangular or box truss construction.
 - f. Trussed arms to be designed so tie rods will not be required.
 - g. Provide blades on the scraper arms to move settled residuals to the bottom center hopper.
 - h. Evenly space blades on each arm so residuals are collected over the full area of the sedimentation basin by each arm.
 - i. Blades with adjustable edges shall be provided and shall have a minimum depth of 6-inches and a minimum length of 3'-0"
 - j. Adjustable neoprene squeegees shall be furnished for all the rake blades and they shall project 1 ½-inches below the bottom of the blades and shall be secured by brass bolts and nuts.
 - k. The scraper arms to conform to the slope of the bottom floor.
 - l. Fabricate the bottom center hopper scraper of 304 stainless steel and attach directly to the center shaft.
16. Plate Settlers with Supports
- a. Provide on complete set of plate settlers with supports for each settling basin.
 - b. Material of construction of the plates to be 316L stainless steel.
 - c. Incline of plates to be 60 degrees.
 - d. Corrugated plates will not be acceptable.
 - e. Plate settlers to be provided with sufficiently supports constructed of 304 stainless steel.
 - f. Support angles will be anchored to the sedimentation basin walls as recommended by the manufacturer.
 - g. Arrangement of settling modules to ensure flow is divided equally between each module without short circuiting.
 - h. Settled solids will slide down the plates and drop into the Microsand/residuals scraper area below.
 - i. Plate packs to be factory assembled in a rigid supporting framework constructed of stainless steel structural shapes
 - 1) Frames to be arranged to permit disassembly of the plat packs to facilitate removal and replacement of individual plates.
 - 2) Frames that rack of deform under load will not be acceptable.
17. Collection Troughs with Supports
- a. Provide v-notch or rectangular notch collection troughs with supports to collect clarified water from the sedimentation basins and discharge the clarified water into effluent chambers.

- b. Each trough effluent launder shall be complete with 90E v-notch or rectangular notch weir plates on both sides.
 - c. Each trough shall discharge to a common area in the Clarifier/Thickener basin.
 - d. The system supplier is responsible for determining the number and dimensions of the troughs per basin.
 - e. Troughs shall be of rectangular cross-section.
 - f. Fabricate the collection troughs from 3/16-inch thick 304 stainless steel.
 - g. Each trough to be shop fabricated and delivered to the site as one continuous unit.
 - h. Field welding to assemble the troughs will not be acceptable.
 - i. Provide suitable lifting lugs on each trough as required for handling and installation.
 - j. Design the troughs to mount into box out openings in the concrete walls at one end of each sedimentation basins.
18. Wear Plates for Bottom Center Hoppers
- a. Provide one wear plate which will be cast into the concrete in each sedimentation basin to protect the concrete from wear.
 - b. Wear plates to be fabricated from 304 stainless steel with angles fabricated from 304 stainless steel for anchoring the plates to the concrete.
 - c. Dimensions, thickness and fabrication details to be as directed by the system supplier.
 - d. Shop fabricate each wear plate with angles.
 - e. Field welding of plates will not be acceptable.
19. Scraper Drive Shaft Protectors
- a. Provide one drive shaft protector with each residual scraper assembly to protect the center drive shaft from the settling plates and to prevent short circuiting of flow around the plate settlers.
 - b. Fabricate drive shaft protectors from 304 stainless steel.
 - c. Dimensions, thicknesses, fabrication details, and mounting details to be as directed by the system supplier.
 - d. Shop fabricate each drive shaft protector and deliver to the site in one complete unit.
 - e. Field welding will not be acceptable.

C. Chemical and Polymer Feed Systems

- 1. Coagulant Storage and Feed System
 - a. Manufacturers: Coagulant feed pumps to be manufactured by Sigma.
 - b. Materials:
 - 1) Diaphragm head - PVC
 - 2) Diaphragm - PTFE or hypalon with EPDM backing.
 - 3) Skid - AISI Type 304L stainless steel
 - 4) Piping - Schedule 80 PVC

- 5) Other materials shall be manufacturer's standard and compatible for continuous service with liquid being pumped.
- c. Provide one system to feed each train.
- d. Coagulant system to be capable of storing and automatically feeding ACH or PACL as required to meet the performance requirements.
- e. Coagulant storage and feed system to consist of the following:
 - 1) Storage tank
 - (i) Storage tank to have a minimum usable capacity of 12,500 gallons.
 - 2) Metering pumps
 - (a) Provide one metering pump capable of feeding coagulant, as required to meet the performance requirements as specified in Section 01112 - Performance Requirements, at a minimum discharge pressure of 65 psi to each feed point.
 - 3) Calibration column
 - 4) Quick connect coupling
2. Polymer System
 - a. Provide one skid mounted system to feed/blend polymer to each train.
 - b. Polymer system to be capable of automatically feeding liquid emulsion polymer as required to meet the performance requirements.
 - c. Polymer feed system to consist of the following:
 - 1) Polymer Feeder/Blender Units
 - (a) Provide a feeder/blender unit for each feed point.
 - (b) Provide a common spare feeder/blender with piping and valving as required to feed to any one of the feed points.
 - 2) Calibration column
 - 3) Secondary dilution water system
 - d. Polymer to be stored in portable chemical totes, to be provided under a separate agreement.
3. Polymer Feeder/Blender
 - a. Manufacturer: Fluid Dynamics or US Filter/Stranco
 - b. Equipment Skid
 - 1) Equipment skid to be sufficiently sized to support polymer equipment.
 - 2) Skid to be constructed of stainless steel with a minimum 3/16 inch thick members with flanged sides.
 - 3) Provide skid with a 1 ½ inch high containment lip along the perimeter to prevent accidental spills from running onto floor.
 - 4) Provide a threaded drain connection with a plug at the low point of the skid.
 - 5) Skid to be designed to permit easy access to equipment and maintenance points without requiring the removal of other components.
 - c. Feeder/Blender
 - 1) Each feeder/blender unit to be capable of automatically metering, diluting, activating, and transferring liquid polymer with water.

- 2) Each feeder/blender to consist of dilution water system, neat polymer pump, blender, controller, flow meter and associated valves, piping, piping components necessary for a complete system
- 3) Dilution Water System
 - (a) Provide a manual rate set valve for on/off control of water flow and an electrically operated valve for modulating control of dilution water.
 - (b) Dilution water control components and piping to include strainers, pressure switches, temperature gauges, pressure gauges, rotameters, and other components necessary for a complete system. Pressure switches shall not allow the system to operate with inadequate water supply pressure.
 - (c) Each system shall have two flow meters to measure primary and secondary dilution water flow into the feeder/blender. The flow range of each meter shall be such that the normal flow rate is at the approximate midpoint of the range.
 - (d) Provide pressure gauges on the dilution water supply and mixing chamber.
- 4) Neat Polymer Transfer Pump
 - (a) Provide one neat polymer transfer pump on each skid to transfer neat polymer with a specific gravity of 1.02 and a maximum viscosity of 3000 cPs from the storage totes (by others) to the activation chamber.
 - (b) Each pump to include continuous local and remote electric and local manual mechanically controlled metering of solution under conditions as required to meet the performance of the HRC system.
 - (c) Pump to be of the electronic solenoid pulse diaphragm type, consisting of a simplex pump head and ball check valves on the inlet and outlet.
 - (d) Pump drive power supply to be rated 120 volts, single phase, 60 Hz.
 - (e) Pump to be manually adjustable by two separate dial knobs, one for adjusting stroke length and the other for adjusting stroke frequency.
 - (f) Provide each pump with an automatic/manual switch which when in automatic, will allow the pump to be remotely adjusted through adjustment of the stroke frequency via a 24 volt DC signal from the polymer system control panel.
 - (g) Materials of construction to be selected for compatibility with polymer.
 - (h) Provide each pump with the following accessories
 - (1) One CPVC duplex basket strainer mounted on the pump suction with socket end connections.
 - (2) One pressure gauge with isolating diaphragm installed in the pump discharge piping.
- 5) Blender Unit
 - (a) Polymer activation may be accomplished by either a hydrodynamic blending device or a motor driven activation device.

- (b) Hydrodynamic Blending Device
 - (1) Device to be cylindrical, non-mechanical specifically designed to dilute and activate polymer.
 - (2) The activation chamber's mixing energy to be staged such that it provides for high, non-damaging mixing energy over the full operating range of the system.
 - (3) Design of chamber shall not expose polymer to excessive shear under any operating rate within the full range of the system.
- (c) Motor Driven Activation Device
 - (1) Device to be a horizontally mounted activation chamber consisting of a rotor and stationary sleeve, each constructed of polymer-resistant synthetic materials.
 - (2) The rotor shall generate a turbulent blending action within a number of horizontal cylindrical chambers internal to the rotor.
 - (3) Polymer shall exit from the chambers through a series of radial openings and pass through a controlled shear zone at the interface of the rotor into the stationary sleeve.
 - (4) Impeller speed not to exceed 3,450 rpm.
 - (5) Motor to be of the TEFC type rated 460 volts, three phase, 60 Hz, and shall be direct coupled to the impeller shaft.
- 6) Controller
 - (a) Each unit to be provided with a single control panel to house controls for local manual and automatic control of the feeder/blender.
 - (b) Provide a single NEMA 4X enclosure.
 - (c) The control system shall provide for automatic adjustment of the polymer and dilution water feed rates to provide the polymer concentration selected and to match the required feed rates as input from the HRC control system.
 - (d) The control panel shall include operating and alarm indicating lights as required to monitor and troubleshoot the system.
 - (e) Provide isolated contact outputs rated a minimum of 5 amperes at 120 volts ac which close to indicate running, loss of water, and system in auto.
- 7) Flow Meters
 - (a) Provide one flow meter in the discharge piping from the neat polymer pump.
 - (b) Flow meters to provide local indication of instantaneous flow rate in gallons per hour and totalized flow in gallons.
 - (c) Wetted parts to be constructed on materials compatible with polymer and shall be rated to withstand the maximum pressure output from the pump.

4. Storage Tanks

- a. Storage tanks to be flat bottom vertical cylindrical tank with flat flange top.
- b. Tanks to be constructed of Fiberglass Reinforced Plastic (FRP) with resins compatible with the chemicals stored.
- c. Provide each storage tanks with the following accessories:
 - 1) Provide a minimum of one side and one top access manway
 - (a) Manway to be minimum 22 inches with flanged connection and fabricated blind flange of the same materials as the tank.
 - (b) Flange diameter and drilling to be in accordance with ANSI B15.5, class 150
 - 2) Flanged piping connections for vent, overflow, fill, drain, discharge, sight level gauge, ultrasonic level gauge connections.
 - 3) Ladder and top handrail meeting applicable OSHA requirements.
 - 4) Clear plastic sight level gauge constructed of clear PVC or borosilicate glass.
 - 5) Level gauge to be provided with:
 - (a) Isolation ball valves
 - (b) Gauge drain valve
5. Metering Pumps
 - a. Pumps to be simplex, motor-driven, reciprocating, mechanically actuated diaphragm type.
 - b. Pumps to include integral motor, oil lubricated gear reducer, cam-and-spring drive mounted in an aluminum housing with plastic corrosion protection.
 - c. Liquid end to be separated from the drive end by a back plate with air gap and weep hole.
 - d. Diaphragms to be nylon reinforced EPDM with PTFE-faced fluid contact surface.
 - e. Pump turndown to be 100:1; 10:1 stroke length by manually adjustment; 10:1 speed adjustment.
 - 1) Stroke adjustment to be in increments of 1%, from 0% to 100%.
 - 2) Speed adjustment to be controlled by DC SCR drive system
 - f. Liquid end to be fully compatible with the chemical being pumped.
 - g. Power supply to the pumps to be 115 VAC, 60 Hz, 1 phase.
 - h. Each pump to be provided with the following accessories:
 - 1) One Y-pattern strainer with 8-mesh screen and O-ring seals.
 - 2) Two properly sized diaphragm type pulsation dampeners for installation in the suction and discharge piping of each pump.
 - (a) Pulsation dampeners to be constructed of materials compatible with pumped chemicals
 - (b) Each pulsation dampener to include air valve and pressure gauge
 - 3) One pressure gauge with isolation dampener to be installed in the discharge piping of each pump.
 - (a) Pressure gauges to be in accordance with Section 13420 - Instruments.
 - 4) One external pressure relief valve sized to pass the maximum displacement of the pump

- 5) One backpressure valve.
6. Calibration Column
 - a. Provide one transparent clear plastic calibrating column to be installed in the pump suction piping.
 - b. Column to be minimum 1-inch ID clear PVC or other resistant, rigid, transparent plastic tubing having a vented top cap.
 - c. Column to be graduated in 0.005 gallon and 20 milliliter increments over a range of 0 to 0.08 gallons/303 milliliters.
 - d. Columns to be by Valcom, Inc. "Model 8500", or "approved equal" items.
7. Quick Connect Coupling
 - a. Provide one quick connect coupling for transport truck unloading connection to the coagulant storage tank.
 - b. Materials of construction to be compatible with the chemical in the storage tank.
 - c. Quick connect couplings to be standard cam and groove type manufactured to specification MIL-C-27487.
 - d. Provide one lockable dust cap with each coupling.
8. Secondary Dilution Water System
 - a. Provide a complete secondary polymer dilution water system for each polymer feed point
 - b. Secondary dilution water system to include the following
 - 1) PVC piping and PVC fittings
 - 2) Check valves
 - 3) Rotameters
 - 4) Flow regulators
 - 5) Solenoid valves
 - 6) Isolation ball valves
 - c. System components to be sized to provide the necessary secondary dilution water as recommended by the manufacturer with a water supply pressure of 65 pig.

2.03 CONTROLS AND INSTRUMENTATION

- A. The SELLER's system shall have the capability to communicate and be controlled by a Foxboro I/A supervisory system located at the Peak Excess Flow Treatment Facility. It is the BUYER's preference to utilize the Foxboro I/A system, integrating the SELLER's controls. All programming and communications needed to allow the Foxboro I/A supervisory system to control the SELLER's equipment shall be provided by the SELLER.
- B. Alternatively, the SELLER may provide a control system utilizing a Programmable Logic Controller with operator interface touchscreen. The programming must have an open protocol so that the Foxboro I/A supervisory system can maintain full control of the SELLER's equipment. All programming and communications needed to allow the

Foxboro I/A supervisory system to control the SELLER's equipment shall be provided by the SELLER.

- C. In addition to the above, provide the following items as part of an integrated control system for controlling each train.
 - 1. One main control panel
 - 2. Ultrasonic level sensors
 - 3. Sludge blanket detectors (if required)
 - 4. Magnetic flow meters (if required)
 - 5. pH analyzers
 - 6. Turbidity meters
 - 7. Pressure switches
 - 8. pH meters
 - 9. Pressure gauges with diaphragm seals
 - 10. Isolation rings/annular seals for pressure instruments
 - 11. Spare I/O
- D. Instrumentation to be in accordance with the requirements of specification section 13420 - Instruments.
- E. Programmable Logic Controller
 - 1. Provide one programmable logic controller based control panel to operate, control, and monitor the HRC system, including flash mixers, reactor turbines, scraper motor drives, sludge recirculation and wasting pumps, Microsand/residuals recirculation, polymer and coagulant feed systems of the trains, and associated equipment.
 - 2. PLC's to have sufficient capacity to allow for control of equipment for up to four (4) additional trains to be added in future expansions of the facility.
 - 3. Provide one Operator Interface Touchscreen accessible from the front cover of the control panel.
 - 4. Programmable logic controllers and OIT's to be in accordance with the requirements of specification section 13451 - Programmable Logic Controllers.
 - 5. All PLC code shall be included in the O&M manual including printed out and fully annotated ladder logic diagrams.
- F. Main Control Panel
 - 1. Furnish one (1) control panel to be located indoors, serving the HRC systems. Provide the following:
 - a. Local panel containing programmable logic controller, contacts, power disconnects, terminal blocks, timers, relays, transformers, pushbuttons, hand switches, status lights, and wiring to operate each train.

- b. Provide controls necessary to allow all pumps and drives to operate in either local or remote modes.
 - c. Provide required I/O points for control, operation, and monitoring of each train installed, plus up to four (4) additional future units.
 - 2. Control panel to be in accordance with the requirements of Section 13451 - PLCs.
 - 3. Control panel shall be completely assembled, tested, and programmed prior to shipment to the site.
- G. Local Control Stations
 - 1. Provide local control stations at each drive consisting of a Hand-Off-Auto switch and start/stop pushbuttons, run light and fail light.
- H. Variable Speed Drives (VFDs) shall be furnished by the BUYER's Contractor and installed in the motor control centers. The BUYER's Contractor shall coordinate with SELLER on VFD and motor starter sizing requirements. SELLER shall submit in writing a letter stating the control options, rating and size information on the electrical equipment have been verified to work with the equipment being supplied. Other systems that provide a functional equivalent will be considered.

2.04 FABRICATION

- A. Shop Assembly
 - 1. Equipment to be shop assembled to the maximum extent possible.

2.05 FINISHES

- A. Shop Priming, Shop Finishing
 - 1. All non-submerged steel surfaces shall be commercial blast cleaned (SSPC-SP6).
 - 2. All submerged steel surfaces shall be near white blast cleaned (SSPC-SP10).
 - 3. Clarifier center drive and motor, mixer gear drives and motors, turbine gear drive and motor, and/or mixer and Microsand/residuals scraper drives and motors and all steel components shall receive one (1) coat of Tnemec 91-H20-Hydro-Zinc with a minimum 3 to 5 mils DFT.
 - 4. Machined surfaces subject to corrosion shall be coated with an easily removable rust preventative compound prior to shipment.
 - 5. Clean, degrease, and pickle items fabricated from stainless steel following fabrication.
 - a. Pickling shall produce a modest etch and shall remove all embedded iron and heat tint.
 - b. Subject pickled surfaces to 24 hour water or a ferroxyl test to detect the presence of residual embedded iron.
 - c. Items with traces of iron detected after pickling shall be re-pickled as required to remove iron traces.

B. Field Painting (By BUYER's Contractor)

1. Field painting shall be the responsibility of the BUYER's Contractor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Equipment Installation

1. Equipment provided under this section will be installed by BUYER's Contractor under a separate contract.
2. The HRC system equipment shall be installed under the direction and in strict conformance with SELLER's installation instructions and based on approved shop drawings.

3.02 FIELD QUALITY CONTROL

A. Special Services to BUYER and BUYER's Contractor

1. Pursuant to Section 01300 - Special Services

B. Site Tests, Inspection

1. Special Services to BUYER for Equipment Checkout, Start-up and Testing, Pursuant to Section 01300 - Special Service.

3.03 ADJUSTING

- A. Special Services to BUYER for Starting and Adjusting, Pursuant to Section 01300 - Special Services.

3.04 DEMONSTRATION

A. Operation and Maintenance Training

1. Special Services to BUYER for Operation and Maintenance Training, Pursuant to Section 01300 - Special Services.

3.05 PROTECTION

A. Stainless Steel Surfaces

1. Protect stainless steel surfaces, after pickling, to prevent contact with iron or steel objects or surfaces.

END OF SECTION

Procurement of High Rate Clarification System
for Peak Excess Flow Treatment Facility /
702056 / 11/04/2003

11515 - 23

High Rate Clarification System Equipment

SECTION 13420

INSTRUMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. This section includes the requirements pertaining to the measurement and control instruments.
- B. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedure.
- C. Related Sections
 - 1. Section 01775 -Closeout Submittals and Procedures
 - 2. Section 01820 - Demonstration and Training
 - 3. Section 13490 - Measurement and Control Commissioning

1.02 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. 51.1-1979 - (R1993) - Process Instrumentation Terminology
 - 2. 5.1-1984 - (R1992) - Instrumentation Symbols and Identification.
- B. Instrument Society of America (ISA)
 - 1. 5.3-1983 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems
- C. National Fire Protection Association (NFPA)
 - 1. 70 - US National Electrical Code
- D. National Electrical Manufacturers Association (NEMA)
 - 1. ICS 1-2000 - Industrial Control and Systems General Requirements.
- E. Underwriters Laboratory (UL)
 - 1. 508 - Industrial Control Equipment
 - 2. 3121-1 - Standard for Safety for Process Control Equipment

1.03 DEFINITIONS

A. Factory Trained Technician

1. An individual who is trained and possesses 5 years minimum experience in the specific technical aspects of the s included in this section, as they are applied in the project. The manufacturer shall provide written certification of the individual's qualifications.

B. Fail Safe

1. Monitor the normally open alarm contact and alarm to the DCS when that contact closes due to an alarm condition.
2. Monitor the power supply to the alarm circuit alarm to the DCS that power to that alarm circuit has been lost.

1.04 SYSTEM DESCRIPTION

A. Design Requirements, Performance Requirements

1. Instrument Construction

- a. All instruments and other components shall be the most recent field models sold by their manufacturers at the time of submittal. Instruments that provide identical functions shall be of the same type and model and shall be of the same manufacturer.
- b. All outdoor instrumentation shall be rated for operation in the ambient conditions at the equipment installation location. Heating and cooling devices shall be incorporated with the outdoor instrumentation where necessary in order to maintain it within its rated environmental operation ranges.
- c. All instrumentation located in hazardous areas shall be intrinsically safe and shall be approved for use in the specific location in which it is to be installed.

2. Signals

- a. Analog control signals shall be electrical and shall vary in direct linear proportion to the measured variable.
- b. Signals outside control panels shall be 4-20 mA.

3. Signal Isolators

- a. Signal isolators shall be furnished and installed in each measurement and control loop wherever required to ensure adjacent component impedance match or where feedback paths may be generated.

4. Signal Converters

- a. Signal converters shall be included where required to resolve any signal level incompatibilities.

5. Readily Accessible
 - a. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance

1.05 SUBMITTALS

- A. Goods Data
 1. Manufacturer's data including materials of construction, equipment weight, dimensions and related information for each item specified in PART 2 GOODS.
- B. Shop Drawings
 1. Provide shop drawings of all instruments and components.
 2. Manufacturers' Instructions
 - a. Manufacturers' instructions for each item specified in PART 2 GOODS.
 - b. Complete user manual including installation, wiring, programming, calibration, communication, diagnostics, troubleshooting, recommended spare parts, and maintenance recommendations or requirements.
 - c. Installation instructions.
- C. Closeout Submittals
 1. Submit in conformance with Section 01775 - Closeout Submittals and Procedures.
 2. Provide listing of programming parameter for each instrument and component. The list shall clearly define which parameters are factory default and which are BUYER selected.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements
 1. The provided instrument shall conform to the following codes:
 - a. UL 508 - Industrial Control Equipment.
 - b. NFPA-79 - National Electrical Code.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading
 1. Prior to shipping, the instrument shall be protected from the environment according to the manufacturer's standard shipping practices.

1.08 WARRANTY

A. Correction Period

1. Pursuant to Section 00700 - General Conditions.

1.09 SYSTEM START UP, COMMISSIONING, AND OWNER'S TRAINING

- A. Pursuant to Section 01750 - Starting and Adjusting, Section 01810 - Commissioning, and Section 01820 - Demonstration and Training.
- B. In conformance with Section 13490 - Measurement and Control Commissioning

PART 2 GOODS

2.01 MANUFACTURED UNITS

- A. Admittance Transmitter for Liquid Level (capacity probe analog)
 1. Provided admittance transmitter shall use radio frequency as the measuring medium.
 2. Provided unit shall have no moving parts to deteriorate or break down.
 3. No routine cleaning or re-calibration shall be necessary.
 4. Unit provided shall have no calibration shifts due to changes in temperature or material densities.
 5. Provided transmitter shall use built in circuitry that ensures accurate measurements regardless of coatings on the sensing element or build-up on the vessel wall.
 6. Temperature and pressure ratings shall be as follows:
 - a. 1000 psi at 100 degrees F
 - b. 500 psi at 300 degrees F
 7. The sensing element shall have the following properties:
 - a. .093 in. maximum outside diameter.
 - b. 400 ft. maximum insertion length.
 - c. ¾-inch NPT connection.
 - d. PFA covered flex cable with stainless steel mounting.
 8. The transmitter shall be powered by 11.5 to 50 VDC and be capable of intrinsic safe operation when supplied from an approved source.
 9. Output range shall be 4-20 mA with a current limit of 28 mA.
 10. Linearity shall be K0.25 percent of full scale.
 11. Maximum load resistance shall be 625 Ω at 24VDC.
 12. Response to step change shall be 20 msec standard (to 90 percent of final value) adjustable from 0.5 to 30 seconds.

13. Fail safe modes shall be field adjustable and shall be as follows:
 - a. Direct acting low-level fail safe in which the current output fails low (current increases as level increases).
 - b. Reverse acting fail safe in which the current fails high (current decreases as level increases).
14. Provided unit shall be capable of operating at ambient temperatures from -40 to 170 degrees F.
15. Calibration adjustments shall be as follows:
 - a. Step zero
 - b. Fine zero
 - c. Step span
 - d. Fine span
 - e. Time delay
16. Transmitter housing shall be rated for the environment used.
17. Provide transmitters with remote mounting from sensing elements.
18. Provide Drexelbrook Model 508-45-25 for conducting liquids or "approved equal" items.

B. Admittance Point Level Controller (capacity probe digital)

1. Provided admittance controller shall use radio frequency as the measuring medium.
2. Provided unit shall have no moving parts to deteriorate or break down.
3. Provided controller shall use built in circuitry that ensures accurate measurements regardless of coatings on the sensing element or build-up on the vessel wall.
4. The controller shall be self-calibrating.
5. Temperature and pressure ratings shall be 200 psi at 450 degrees F.
6. The sensing element shall have the following properties:
 - a. ¾-inch NPT connection.
 - b. Wetted parts shall be constructed with 316 SS.
7. Operating temperature shall be from -40 degrees F to 140 degrees F.
8. Instrument housing shall be rated for environment used.
9. Provided output shall be a single DPDT relay contact with a contact rating of three-amp non-inductive 120 VAC, or 24 VDC.
10. Provide Drexelbrook NoCal LCS Model 507-6000 RF Point Level Controller for conducting liquids or "approved equal" items.

C. Variable Area Flowmeter (Rotometer)

1. As required for measuring low flow rates for liquids, provide low capacity variable area flowmeters as follows:
 - a. Meter scale length shall be three inches and shall be direct reading.
 - b. Provide unit with integral stainless steel control valve mounted on the bottom and adjusted from the front of the unit.
 - c. Metering tube shall be easily removable for range change or cleaning without removing the meter from the line or without the use of tools.
 - d. Performance levels shall be:
 - 1) Repeatability of 0.5 percent of full scale reading.
 - 2) Accuracy for a 3-inch scale shall be 10 percent full scale for standard accuracy and 4 percent full scale for optional increased accuracy.
 - 3) Rangeability of 10 to 1 or greater.
 - e. Operational limits shall be:
 - 1) Ambient temperature from 32 to 140 degrees F.
 - 2) Minimum pressure shall be a full vacuum
 - 3) Stainless steel fittings and adapters shall provide:
 - (a) Maximum process temperature of 250 degrees F.
 - (b) Maximum process pressure of 250 psig.
 - f. Materials of construction shall be:
 - 1) Tube shall be Borosilicate glass.
 - 2) End fittings, tube adaptor and tube adaptor spring shall be 316 stainless steel.
 - 3) Body shall be 304 stainless steel.
 - 4) Shield shall be polycarbonate.
2. Provide Porter & Fisher (ABB) Series 10A6100 Purgemaster or "approved equal" item.

D. Ultrasonic Level Transmitter

1. Provide transmitter capable of the following functions:
 - a. Non-contacting level monitoring system.
 - b. Control up to five pumps.
 - c. Measure differential level.
 - d. Monitor open channel flow.
 - e. Measure tank level and provide volume conversion.
2. Ambient temperature shall be from -20 to 50 degrees C.
3. Remote transmitter enclosure shall be provided with a polycarbonate construction rated NEMA 4X.

4. Range shall be from 1 to 50 feet.
5. Transmitter accuracy shall be 0.25 percent of range or 0.24 inches, whichever is greater.
6. Resolution shall be 0.1 percent of program range or 0.08 inches, whichever is greater.
7. Memory shall be EEPROM (non-volatile) with no back-up battery required.
8. Programming shall be via removable programmer with a LCD display of four digits at 0.7-inch high minimum.
9. Outputs shall have the following characteristics:
 - a. Transducer drive frequency of 41 kHz, 400 V peak pulses of 1 msec max. duration at a max. repetition rate of 300 msec.
 - b. Relay output of five alarm/control relays, one form 'C SPDT contact per relay, rated five A at 250 VAC non-inductive
 - c. Current isolated analog output of 4 to 20 ma with a resolution of 0.1 percent of range and a maximum loading of 600 Ω .
10. Cable construction between transmitter enclosure and probe shall be manufacturer's supplied cable.
11. Approvals shall be FM and CSA.
12. Provide the following Goods:
 - a. Milltronics HydroRanger with optional Lis-1 loop isolator or "approved equal" items.
 - b. Milltronics XPS-15 probe or "approved equal" item.

E. Liquid Level Pressure Transmitter

1. Provide transmitters with the following characteristics:
 - a. Two-wire, capacitance or piezoresistive, high-performance level transmitter.
 - b. Transmitter housing and mounting brackets shall be stainless steel.
 - c. Mounting brackets provided shall be stainless steel.
2. Transmitters shall be supplied with the following references:
 - a. National Electric Code (NFPA 70) 501-5 by incorporating a two-compartment electronics housing for separation of the process medium and the electrical conduit.
 - b. National Electrical Manufacturer's Association (NEMA) standard number ICS6 "Enclosure for Industrial Controls and Systems," 4X.
 - c. Factory Mutual (FM), Canadian Standards Association (CSA), CENELEC, and SAA standards for explosion-proof enclosure and intrinsically safe electronic circuitry.
 - d. Manufacturer must be certified as meeting the requirements of ISO 9001.

3. The provided transmitter shall be suitable for the following ambient conditions:
 - a. Humidity: 0–100 percent relative humidity.
 - b. Temperature Limits: –40 to 185 degrees F.
4. Transmitter shall have a dual-compartment housing with a moisture barrier completely isolating the electronic circuitry from the field wiring and calibration terminals.
5. The following process conditions shall be met:
 - a. Suitable for liquid, gas, and vapor service.
 - b. Process Temperature Limits:
 - 1) Silicone fill: –40 to 250 degrees F with Coplanar flange. –40 to 300 degrees F with traditional flange.
 - 2) Inert fill, above atmospheric pressure: 0 to 185 degrees F.
6. Electrical connections shall be ¾-inch 14 NPT.
7. Transmitter shall operate on 10.5 to 55 VDC, with no load (6–12 VDC with no load for low power option).
8. Individual range provided shall be as required by process.
9. Transmitter outputs shall conform to the following:
 - a. Outputs shall be 4–20 mA analog signal.
 - b. Analog output shall be adjustable remotely with a field communicator or control system.
 - c. Zero and span adjustments shall be available on the transmitter.
10. Data shall be stored in nonvolatile EEPROM memory.
11. Provided transmitters shall have the following software compatibility :
 - a. The transmitter shall perform continuous diagnostics, capable of self-test functions and be able to provide specific diagnostic information locally on the meter and remotely.
 - b. The configuration capabilities of the transmitter shall allow the user the ability to input and store information including the range, engineering units, damping, square root or linear output, drain/vent valves, flange, and O-ring materials, date, message, descriptor, tag number, serial number, and remote seal information.
 - c. Process variable and sensor module temperature information shall be available digitally.
 - d. Transmitter software security shall be user selectable.
 - e. Upscale/Downscale failure mode shall be user selectable.
12. As a minimum, the transmitter shall meet the following performance criteria:
 - a. Total Performance [over ±50 degrees F, 1,000 psi line pressure] of ±0.15 percent of span

- b. Stability [over ± 50 degrees F, 1,000 psi line pressure] of:
 - 1) ± 0.125 percent of URL for 5 years.
 - c. Accuracy shall be ± 0.075 percent of Calibrated Span.
 - d. Total ambient temperature effect per 50 degrees F shall be $\pm (0.0125$ percent URL + 0.0625 percent span) spans from 1:1 to 30:1
 - e. Time response shall be:
 - 1) Dead Time: 45 milliseconds (nominal).
 - 2) Time Constant: 55 milliseconds.
 - 3) Update Rate: 20 times per second (minimum).
 - f. Vibration effect shall be $\pm$ PMC 0.1 percent of URL when tested from 15 to 2,000 Hz per SAMA 31.1.
 - g. Vibration effect shall be less than ± 0.1 percent of span from 20 to 1,000 MHz for field strength of 30 V/m per IEC 801-3.
 - h. Provide transmitters capable of the following options:
 - 1) Digital LCD indicator with diagnostic capabilities.
 - 2) Remote diaphragm seals.
 - 3) 4,500 psi line pressure.
 - 4) High temperature (375 degrees F).
 - 5) Level flanges.
 - 6) Low power electronics.
 - 7) Factory-assembled primary elements.
13. Rosemount Model 3051L liquid level transmitter or "approved equal" item.

F. pH Transmitter

- 1. For measuring process pH levels, provide pH transmitters with the following specifications:
 - a. The front mounted LCD display shall consist of:
 - 1) Main display of three digits each 12.5 mm high.
 - 2) Message display of six alphanumeric characters, seven mm high.
 - 3) Warning flags and units (pH and mV).
 - b. Data protection shall be through the use of EEPROM for configuration and logbook features and lithium battery for the clock.
 - c. Unauthorized use shall be prevented through the use of a 3 digit programmable password.
 - d. Calibration shall be semi-automatic using preconfigured NIST buffer tables with manual adjustment to grab sample.
 - e. Input ranges shall be:
 - 1) pH - from -2 to 16 pH

- 2) ORP - from -1500 to 1500 mV
- 3) rH - from 0 to 55 rH
- 4) Temperature - from -30 degrees C to 140 degrees C
- f. Span shall be:
 - 1) pH - min. of 1 & max. of 20 pH
 - 2) ORP - min. of 100 & max. of 2000 mV
 - 3) rH - min. of 2 & max. of 55 rH
 - 4) Temperature - Min. of 25 degrees C & max. of 200 degrees C
- g. Output signal shall be
 - 1) 4-20 m
 - 2) Loop powered
 - 3) Isolated from input
 - 4) Maximum load of 550 ohms at 24 VDC.
- h. Operating environment conditions shall be as follows:
 - 1) Ambient operating temperature shall be from -10 to +55 degrees C.
 - 2) Humidity from 10 to 90 percent RH.
- i. Provide unit with FM certification.
- j. Enclosure shall be constructed of cast aluminum case with chemically resistant coating and rated NEMA 4X.
- k. Provide pH sensor with the following characteristics:
 - 1) Operating range from 2 to 12 pH and -10 to 105 degrees C.
 - 2) Process connection of 3/4in. NPT male fitting.
 - 3) Operating limits:
 - (a) Flow velocity from 0 to 2 m/s.
 - (b) Salt content (for conductivity) minimum of 50 µS/cm.
 - 4) Provide pH sensor with built-in temperature compensation.
- 2. Provide Yokogawa Model PH202G-U-E/U/Q pH Transmitter with Model FU20-05-T1-NPT Sensor, or "approved equal" items.

G. Pipe Pressure Sensor

- 1. For measuring process pressures with pipe mounted sensors, provide pipe pressure sensors as per the following specification:
 - a. Method of sensing process pressure shall be:
 - 1) Sensed 360 degrees through a flexible rubber sleeve.
 - 2) Captive fluid internal to the sleeve shall be displaced to the sensor's Bourdon tube.
 - 3) All instrumentation shall be isolated and protected from the process.

- b. Pressure sensor shall be of light weight design and fit the following pipe systems:
 - 1) Class 150 and 300 flange drilling
 - 2) DIN
 - 3) BS NP10
 - 4) Ability to fit other piping systems.
- c. Materials of construction shall be:
 - 1) Carbon steel body
 - 2) Flanges shall be constructed of 316 stainless steel.
 - 3) Sleeve elastomer shall be as required for the environment used.
 - 4) Fill fluid shall be Glycol and water 200 degrees F.
- 2. Provide Red Valve Series 48 pipe pressures sensors, or "approved equal" item.

H. Pressure/ Differential Pressure Switch

- 1. Switch enclosure shall be rated NEMA 4X.
- 2. The provided switch shall be capable of either pressure or differential pressure operation.
- 3. Deadband adjustments shall be either fixed or fully adjustable.
- 4. Switch contacts shall have the following options available:
 - a. Maximum ratings of 15 amps at 480 VAC.
 - b. Hermetically sealed contacts.
- 5. The pressure switch shall have the option of either a single setpoint or dual setpoints.
- 6. Pressure ranges shall be from -30 in. H₂O (Vacuum) to 3000 psi.
- 7. Process temperature limits shall range from 0 degree F to 300 degree F. Individual range provided shall be as required for the environment used.
- 8. Pressure connection materials shall be available as follows:
 - a. Pressure psi ranges shall use 316L stainless steel.
 - b. Differential psid ranges shall use nickel-plated brass.
- 9. Approvals shall include UL, CSA and FM ratings.
- 10. Choice of actuators shall include designs for fire-safe and NACE applications.
- 11. Provide Ashcroft L Series pressure/ differential pressure switches, or "approved equal" items.

I. Turbidimeters

- 1. Analyzers to operate with a continuous flow of sample water through the sample cell to drain.
- 2. Unit to operate by passing a strong light through the sample and measuring the amount of light scattered by the turbidity particles.

3. Analyzer to utilize a US EPA approved method of turbidity analysis.
4. Lamp to operate below rated voltage to extend operating life.
5. Reflected light intensity to be monitored by a silicon photocell.
6. Sample cell to be constructed of corrosion resistant materials and have an integral bubble trap.
7. Provide necessary accessories to field calibrate the sample cell output.
8. Provide a secondary calibration standard utilizing an optical glass calibration cube with a known NTU value.
9. Provide the analyzer with a master indicator suitable for mounting near the sample cell, connected via a special cable.
10. Auto-ranging three or four digit display:
 - a. Low - 0.001 NTU
 - b. High - 100 NTU
11. Provide a NEMA Type 12 moisture-resistant enclosure for housing the master indicator.
12. Output to be 4-20 mA dc output corresponding to a pre-selected turbidity range.
13. Unit to have a minimum of two alarm output relays, one for high and one for low turbidity, or other pre-selected alarms as required by the HRC equipment manufacturer.
14. Turbidity analyzers to be Great Lakes Instruments, model T53-8320, Hach Chemical Company, model 1720D, or "approved equal" items.

J. Sludge Blanket Level Interface Analyzer

1. For the analysis and display of all solids interfaces present in a chosen liquid column, provide an analyzer/ transmitter with the following specifications:
 - a. Analyzer shall use an ultrasonic ranging technique to measure the depth of interfaces.
 - b. Analyzer shall be microprocessor controlled with self test and automatic calibration capabilities
 - c. Complete unit shall consist of the following:
 - 1) Analyzer
 - 2) Transceiver
 - 3) Sensor
 - d. Sensors shall have the following characteristics:
 - 1) Be provided with a minimum of 25 feet and capable of a maximum of 75 feet of cable.
 - 2) Have dual head construction and be mounted just below the surface of the medium.

- 3) If shown on Contract Design Drawings, provided with an optional hinged bracket to allow surface skimmer passage.
- e. Analyzer shall be provided with a back-lit LCD display that shall show the following functions:
 - 1) Step by step start up startup instructions.
 - 2) Display profiles of the entire liquid column showing all solids interfaces with continuous updating capability.
 - 3) Trend of a specific level of interest covering the last 24 hours of operation.
 - 4) Display help screens.
- f. The range shall have the following parameters:
 - 1) Monitor from 1 to 99 feet and read in:
 - (a) Feet
 - (b) Meters
 - (c) Percent of depth.
 - 2) Dead zones shall be no more than one-foot from sensor and two inches above tank bottom
 - 3) Level resolution shall be as follows:
 - (a) 0.1 feet to 25 foot depth
 - (b) 0.2 feet to 50 foot depth
 - (c) 0.3 feet to 75 foot depth
 - (d) 0.4 feet to 100 foot depth
 - 4) Ambient temperature/ humidity conditions shall be:
 - (a) From -30 to +80 degree C for standard sensors.
 - (b) Instrument relative humidity from 5 to 100 percent, non-condensing.
 - (c) Instrument ambient temperature from -10 to 50 degree C
 - 5) The output shall be 4-20 mA isolated and capable of being scaled to any range.
 - 6) Power requirements shall be 115 VAC.
 - 7) Enclosure shall be rated NEMA 4X.
2. Provide Royce Model 2501A interface level analyzer with Model TR-25 transceiver and Model 25DN or Model 25DHE sensor.

K. Flowtube Magnetic Flowmeter

1. Meter units (flow tube and transmitter) shall be rated NEMA 4X (IP 67).
2. Sizes shall vary from .5-inch through 36-inch..
3. Minimum conductivity of the measured liquid shall be $^35\text{mS/cm}$.
4. Lining material shall be Polyurethane.

5. Electrode material shall be 90 percent Platinum and 10 percent Iridium.
6. Flowtube construction shall be flanged and manufactured with 316 Stainless Steel.
7. Provide transmitter with the following requirements:
 - a. Transmitters shall be 4-wire instruments and shall use 120VAC for instrument power.
 - b. Available output signal shall be current output at 4-20 mA.
 - c. The transmitter enclosure shall be rated NEMA 4X (IP 67).
 - d. All mounting brackets, screws, bolts and other hardware shall be constructed of Stainless Steel.
 - e. Repeatability shall be ± 0.1 percent of reading and ± 0.005 percent of maximum full-scale value.
 - f. The transmitter shall be integral with the flowtube.
 - g. Accuracy
 - 1) System accuracy shall be ± 0.5 percent of rate from 1 to 30 ft/s (0.3 to 10 m/s)
 - 2) Between 0.04 and 1.0 ft/s (0.01 and 0.3 m/s), the accuracy shall be ± 0.005 ft/s.
 - 3) Analog output shall have the same accuracy as frequency output plus an additional 0.05 percent of span.
 - h. Flow rate range
 - 1) Capable of processing signals from fluids that are traveling between 0.04 and 30 ft/s (0.01 to 10 m/s) for both forward and reverse flow in all flowtube sizes.
 - 2) Full scale continuously adjustable between -30 and 30 ft/s (-10 to 10 m/s).
 - i. Operating Ambient Temperature Limit
 - 1) A minimum range of from -30 to 150 degree F (-34 to 66 degree C) without local operator interface.
 - j. Storage Ambient Temperature Limit
 - 1) Shall be from -22 to 176 degrees F (-30 to 80 degree C).
 - k. Humidity Limit
 - 1) Shall be from 0–100 percent RH at 120 degree F (49 degree C), decreasing linearly to 10 percent RH at 130 degree F (54 degree C).
 - l. Analog Output Adjustment
 - 1) 4–20 mA, jumper-selectable as internally or externally powered 5 to 24 VDC; 0 to 1000 W load.
 - 2) Engineering units—lower and upper range values shall be user-selectable.

- 3) Output shall be automatically scaled to provide 4 mA at lower range value and 20 mA at upper range value.
 - 4) Full scale shall be continuously adjustable between -30 and 30 ft/s (-10 to 10 m/sec), 1 ft/s (0.3 m/s) minimum span.
 - 5) HART Communications, digital flow signal, shall be superimposed on 4–20 mA signal and shall be available for control system interface.
- m. Scalable Frequency Output Adjustment
- 1) The range shall be from 0-1000 Hz, externally powered at 5 to 24 VDC and translator switch closure up to 5.75 w.
 - 2) Pulse value shall be set to equal desired volume in selected engineering units.
 - 3) Pulse width shall be adjustable from 0.5 to 100 m/s.
- n. Auxiliary Output Function
- 1) Shall be externally powered at 5 to 24 VDC, transistor switch closure up to 3 W and shall indicate either one of the following:
 - (a) Reverse Flow shall activate a switch closure output when reverse flow is detected and shall be displayed
 - (b) Zero Flow shall activate a switch closure output when flow goes to zero ft/s.
- o. Software Lockout
- 1) A security lockout jumper shall be provided on the electronics board that can be set to deactivate all HART-based communicator functions to protect configuration variables from unwanted or accidental change.
- p. Turn-on Time
- 1) Shall be 30 minutes to rated accuracy from power up, five seconds from power interruption.
- q. Start-up Time
- 1) Shall be 0.2 seconds from zero flow.
- r. Low Flow Cutoff
- 1) Shall be adjustable between 0.04 and 1 ft/s (0.01 and 0.3 m/s).
 - 2) When below selected value, the output shall be driven to the zero flow rate signal level.
- s. Over range capability
- 1) Signal output shall remain linear until 110 percent of upper range value or 33 ft/s.
 - 2) The signal output shall remain constant above these values.
 - 3) Out of range message shall be displayed on the HART Communicator.
- t. Damping
- 1) Shall be adjustable between 0.2 and 256 seconds.

- u. Flow Tube Compensation
 - 1) Flowtubes shall be flow-calibrated and assigned a calibration factor at the factory.
 - 2) The calibration factor shall be entered into the transmitter, enabling interchangeability of flowtubes without calculations or a compromise in accuracy.
- v. Hazardous Locations Certifications
 - 1) Shall be Factory Mutual (FM) Approval Non-incendive, flammable and non-flammable fluid service for Class I, Division 2 Groups A, B, C, and D; Dust-ignition proof for Class II/III, Division 1 Groups E, F, and G hazardous locations.
- w. Response Time
 - 1) Shall be 0.2 seconds maximum response to step change in input.
- x. Stability
 - 1) Shall be ± 0.1 percent of rate over six months.
- y. Ambient Temperature Effect
 - 1) Shall be ± 1 percent per 100 degree F (37.8 degree C).
- z. RFI Effect
 - 1) Shall be Class 1, A, B, C: ± 0.5 percent of span at 3 V/m per SAMA PMC 33.1, wires and conduit.
- aa. Supply Voltage Effect
 - 1) Transmitter shall meet supply voltage effect requirements of SAMA PMC 31.1, Section 5.10.1 through 5.10.5.
 - 2) Transmitter shall withstand surges in supply voltage as specified in IEEE 472, 1974
- 8. Provide the following Goods:
 - a. Provide Rosemount Series 8705 Flowtube Magnetic Flowmeter with Rosemount Series 8712C Transmitter, or Krone Aquaflux Model 4/10 KF, or "approved equal" items.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Factory Trained Technician shall examine the installation and certify with a written report that the installation is in accordance with the manufacturer's instructions.
- B. Factory Trained Technician shall perform the calibration and commissioning. The technician shall certify in writing that the instrument is performing in accordance with the Manufacturers Requirements.

3.02 INSTALLATION

- A. Instruments provided under this section are to be installed on shop assembled skid packages as specified in the detailed equipment sections, or by a BUYER's Contractor under a separate agreement.

3.03 ADJUSTING

- A. Provide commissioning as required by Section 13490 - Measurement and Control Commissioning.
 - 1. The overall accuracy of each instrumentation system or loop shall be as indicated in the specification for that system or loop. Each individual instrument shall have a minimum accuracy of ± 0.5 percent of full scale and a minimum repeatability of ± 0.25 percent of full scale.

3.04 DEMONSTRATION

- A. Provide training to BUYER's staff pursuant to Section 01820 - Demonstration and Training.

—END OF SECTION—

SECTION 13451

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. This section includes the requirements for the programable logic controller, operator interface terminal, and related control components.
- B. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures.

1.02 REFERENCES

- A. Underwriters Laboratory - U. L. 508
- B. National Electric Code - NEC 70

1.03 SYSTEM DESCRIPTION

- A. This system provides the capabilities for sensing control conditions of equipment and determining the needed response to maintain the process controlled by the equipment. The PLC shall be programmed to react to the predetermined operational parameters and limits to minimize the operator monitoring and control. The operator may also override the PLC process with the ability to manually override the automated operation at the process level. The PLC maintains the alarm conditions programmed into the system and is capable of automated responses to mitigate the alarm condition with little or no operator intervention.

1.04 SUBMITTALS

- A. Goods Data
 - 1. Manufacturer's data including materials of construction and related information for each item specified in PART 2 GOODS.

B. Shop Drawings

1. Dimensional drawings showing the overall length, width and height of the assembled control panel/ center. Included on these drawings shall be the back panel layout of installed control devices showing part numbers, dimensions, nameplate text and other details required for a complete assembly.
2. For large control panel/ centers, physical properties, handling, mounting and, if applicable, shipping break point locations shall be shown in the drawings. This shall include total weight, lifting instructions, height and floor space required.
3. Electrical Schematic Drawings that include wiring details such as terminal block numbers for both internal and field connections, shielded wire termination requirements, grounding requirements, wire colors and numbers, etc., shall be provided. Show all required internal and external interlocking. Each drawing shall be circuit specific for the system submitted on. No typical schematic drawings shall be approved.
4. All drawings shall list the equipment number of the box, control panel/ center submitted on and the equipment number of connected field components.
5. Complete Bills of Materials shall be included with and shown on the Schematic or Panel Construction drawings for each box, control panel/ center.

C. Closeout Submittals

1. Sequence of operation
2. Screen and screen transfer control
3. Alarm operation
4. Software control program
5. I/O tagging data base
6. Alarm schedule
7. PLC programming and documentation
8. OIT programming and documentation
9. PID control parameter scaling and documentation
10. Alarm detection, operator acknowledged , alarm recall, and alarm cancel.
11. Analog monitored level detection calibration
12. Peripheral Device interface communication and software.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Equipment provided as part of this section shall be manufactured by a single firm, regularly engaged in the design and manufacture of such equipment for a minimum of five years.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Equipment to be stored and installed in a dry heated environment, by the general contractor responsible for the installation.
- B. SELLER to provide instructions for proper storage of the equipment prior to installation.

1.07 WARRANTY

- A. Correction Period
 - 1. Pursuant to Section 00700 - General Conditions.

1.08 SYSTEM START UP, COMMISSIONING, AND BUYER'S TRAINING

- A. System Start Up
 - 1. Pursuant to Section 01750 - Starting and Adjusting.
 - 2. Pursuant to Section 01810 - Commissioning.
- B. BUYER's Training
 - 1. Pursuant to Section 01820 - Demonstration and Training.

1.09 MAINTENANCE

- A. Provide Operation and Maintenance Data and Manuals Pursuant to Section 01785 - Operation and Maintenance Data.
- B. Extra Materials
 - 1. SELLER shall provide the following spare parts:
 - a. Five of each type of I/O fuse used.
 - b. One PLC power supply.
 - c. One PLC CPU module. Furnish the CPU module with the largest memory size installed.
 - d. One of each type of I/O Rack used.
 - e. One of each type of I/O Module used in the project.

PART 2 GOODS

2.01 COMPONENTS

- A. Backplane Mounting Rack (I/O Rack)
 - 1. The CPU module, power supply and I/O modules shall be mounted in a suitable housing designed by the PLC manufacturer for this purpose.

2. Individual housing slots shall be mechanically configurable to prevent insertion of incorrect modules.
3. Each I/O rack shall have sufficient slots to provide, at a minimum, two spare slots after all required I/O modules have been installed.
4. Allen-Bradley or "approved equal" item.

B. Central Processor Unit Module

1. The Central Processing Unit (CPU) shall be of solid-state, Low Power Substrate (CMOS) semi-conductor design.
2. All CPU operating logic shall be contained on plug-in modules for quick replacement.
3. CPU shall have sufficient memory to implement the specified control functions plus a reserve capacity of 20 percent of the total programming provided to ensure capacity for future program additions.
4. Each CPU shall be programmable in lower level "ladder diagram" language consisting of multiple series or parallel contacts, counters, timers and arithmetic functions.
5. Higher level programming shall consist of, but not be limited to P&ID functions, trigonometric and floating-point math calculations.
6. Each CPU shall also have a built-in real time clock/calendar available for programming use.
7. Each CPU shall be supplied with a ram that is battery backed up. An indicator shall show the status of the batteries. The battery shall be internally mounted and be a Lithium type that is capable of retaining the program for up to one year after power loss.
8. The CPU shall execute status check upon power up and continuously during operation.
9. CPU status information shall be accessible by the software programmer. Information shall indicate running or failure status of the PLC system, i.e., communication port error, scan time error, I/O failure location, etc.
10. In addition to a high speed DH+ data network programming port, the CPU shall have a second built-in serial communication port, an RS-232-C port that can be configured for ASCII and processor protocol communications.
11. Allen-Bradley or "approved equal" item.

C. Power Supply

1. The power supply shall be mounted in the PLC I/O rack integral with the CPU module.
2. Power supply to be sized to allow the future expansion need of the I/O rack full capacity.
3. Allen-Bradley or "approved equal" item.

D. 24 VDC Digital Input Modules

1. Modules shall have 16 inputs each, LED's to indicate status of inputs and shall operate from 24VDC (nominal) input signals. Maximum signal delay on of 15ms dc /25ms ac and delay off of 15ms dc/ 25 ms ac. The maximum off-state current shall be 1 mA.
2. Allen-Bradley or "approved equal" items.

E. 24 VDC Digital Output Modules

1. Modules shall have 16 outputs each, LED's to indicate status of inputs and shall operate from 24VDC (nominal) signals. Maximum signal delay on of 15 ms dc /25ms ac and delay off of 15ms dc/ 25 ms ac. The maximum off-state current shall be 1 mA.
2. Allen-Bradley or "approved equal" item.

F. Analog Input Modules

1. Modules shall have 8 (4-20 mA) inputs each and LED's to indicate status of inputs. Each input channel shall be electrically isolated from each of the others. The maximum step response time shall be 2.5ms with update period of 512 Fs.
2. Allen-Bradley or "approved equal" item.

G. Analog Output Modules

1. Modules shall have 4 (4-20 mA) outputs each and LED's to indicate status of inputs. Each input channel shall be electrically isolated from each of the others. The maximum step response time shall be 2.5 ms with update period of 512 Fs.
2. Allen-Bradley or "approved equal" item.

H. Operator Interface Terminal

1. Each PLC shall have an Operator Interface Terminal (OIT).
2. Each OIT shall be capable of displaying operating data, alarms, set points, etc., by a graphic color touch screen and shall have the following characteristics:
 - a. Display shall be LCD color, 8.3 in wide x 6.2 in high with 384 touch cells and capable of generating graphics to display trends and access PLC data.
 - b. The OIT shall utilize not only a touch screen display but also employ a sealed membrane keypad (with 16 functions keys) both of which will allow access to and enable data entry to the PLC program.
 - c. The OIT shall also be provided with a DH+ high speed data network communication port capable of interfacing directly to the CPU communication port.
3. The OIT shall provide a full complement of operator devices and be capable of applying user defined graphic symbols including push buttons, selector switches, numeric and ASCII entry devices, diagnostic indicators, message displays, embedded numbers, ASCII variable displays and other devices.

4. The OIT shall also have an extensive alarm capability that uses an alarm list to record and display important data on triggered alarms with buttons for printing or clearing the list.
 5. An alarm banner shall be used to notify an operator when an alarm occurs by displaying a message and providing buttons for alarm response.
 6. Enclosure ratings shall be NEMA Type 12.
 7. Provide an Allen-Bradley Panelview 1000 or "approved equal" item.
- I. PLC and OIT programming software:
1. Provide programming software for the PLC control logic, data network, and operator screen generation as required for the PLC system and peripherals.
 2. Allen-Bradley or "approved equal" item.
 3. SELLER to provide software operational programs for both the PLC and OIT systems.
- J. Control panels shall comply with the following:
1. Enclosures shall be NEMA 4/12 construction with hinged and gasketed doors.
 2. Provide enclosures with aluminum backpanels for all wall mounted enclosures 60in.H x 36in.W and smaller and in free standing enclosures when available.
 3. Provide all enclosures with door locking features or assemblies.
 4. Provide the following enclosures:
 - a. For wall mount enclosures in dedicated electrical rooms, provide Hoffman Bulletin CWS "Concept" Type 4/12 w/Aluminum Panels or "approved equal" item.
 - b. For free standing enclosures in dedicated electrical rooms, provide Hoffman Bulletin P20 "Proline" Type 12 or "approved equal" item.
- K. Enclosure Lighting:
1. The lighting fixture shall be fluorescent and operate at 115VAC.
 2. Provide fixtures with a manually operated on/off switch.
 3. The size of the fixture provided shall be as large as can physically fit inside each enclosure.
 4. Provide Hoffman Cat. No. A-LF Fluorescent Light Fixtures w/Manual Switches or "approved equal" item.
- L. Corrosion Inhibitors
1. For each control panel enclosure, provide corrosion inhibitors.
 2. Provide emitter type inhibitors with the number of units based on manufacturer's recommendations. Corrosion inhibiting strips or foam pads shall not be acceptable.
 3. Provide Hoffman Cat. No. A-HCI10E or "approved equal" item.

M. Wire Ducts

1. Panel mounted wire ducts shall be constructed from rigid plastic duct.
2. Wire ducts mounted next to terminal strips and controller I/O racks shall be sized 3 inches wide at a minimum. Other ducts shall be sized at a minimum according to the NEC.
3. For wire ducts two inches wide and larger, use wire retainers provided by the manufacturer for the purpose. Place retainers every 12 inches throughout all two- inch and larger wire duct.
4. Wire Ducts shall be large enough to provide a wire fill area no more than 40 percent of the total cross sectional area. Reference charts provided by the manufacturer for maximum wire fill for each size used.
5. Wire ducts shall be attached to the back panel with screws or plastic fasteners that are approved for the use and provided by the wire duct manufacturer. Wire ducts shall not be attached to back panel or enclosure side surfaces with glue or other such adhesives.
6. Wire ducts shall have slotted sides and be provided with removable covers.
7. Provide Panduit Type G Light Grey Wall Duct w/WR2-C20, WR3-C20, or WR4-C20 Wire Retainers, or "approved equal" items.

N. Spiral Wrap:

1. For all single conductors and cable wire assemblies included in the "hinge wrap," defined as conductors routed to control enclosure doors and looped across door hinge areas, provide spiral wrap protective wrapping.
2. Provide Panduit Spiral Wrapping or "approved equal" item.

O. Conductors:

1. For power and discrete control signal wires, conductors shall comply with the following:
 - a. They shall be flexible stranded copper, machine tooled wires.
 - b. They shall be UL listed, type MTW, and shall be rated at a minimum of 600 volts.
 - c. Solid conductors shall be used except as may be required for equipment grounding.
 - d. Provide Belden MTW or "approved equal" item.

P. Circuit Breakers for Control Circuits:

1. For control circuits protected between 10 and 2 amps, provide circuit breakers with the following specifications:
 - a. Energy Limiting features.
 - b. Fault characteristics:
 - 1) F trip characteristic ($3...5 \times I_n$) for low fault tolerant loads, such as PLC outputs, solid state control equipment and also for selective action with an upstream fault device.

- 2) G trip characteristic ($6 \dots 10 \times I_n$) for standard duty loads, such as relay coils, control circuitry, and test equipment.
- 3) H trip characteristic ($12 \dots 20 \times I_n$) for high inrush loads, such as power supplies, heaters, and transformer primaries.
- c. Din rail mounted.
- d. Provide with the following control capabilities:
 - 1) Auxiliary contacts that activate when the main pole changes position.
 - 2) Signal contacts that activate only during fault conditions.
 - 3) Shunt trip that allows the breaker to trip from a remote source.
2. Provide Allen-Bradley Bulletin 1492-CB circuit breakers or "approved equal" item.

Q. Fuse Holders

1. When using fuse types other than 1/4-inch round by 1 1/4-inch long, use fuse holders with the following specifications:
 - a. Holders shall be IEC529 rated for finger protection with dead front construction.
 - b. The holder shall open such that the fuse is isolated from the line when the handle is opened for fuse insertion or removal.
 - c. Provided with blown fuse indicators.
 - d. Din rail mounted.
 - e. 30 amp frame size accepting from 0 to 30 amp Class CC fuses.
 - f. Rated 600VAC or VDC with 200 amp withstand rating.
 - g. Available in 1, 2 or 3 pole varieties.
 - h. Accept copper wire sizes from #14 through #6 AWG.
 - i. Rejection features to prevent the use of fuses that do not have Class CC fuse interrupt ratings.
2. Provide Allen-Bradley Bulletin 1492-FB fuse holders or "approved equal" item.

R. Power Supplies

1. For instrument loops and other low voltage DC requirements as shown on Contract Design Drawings, provide power supplies with specifications as listed below:
 - a. Input power shall be 120 VAC.
 - b. Output characteristics shall be as follows:
 - 1) For a 10 percent change in input voltage, the output shall vary no more than 0.05 percent.
 - 2) For a 50 percent change in the connected load, the output voltage shall vary no more than 0.05 percent.
 - 3) Maximum ripple shall be 3.0 mV peak-to-peak.
 - 4) Minimum DC output adjustment range shall be K5 percent.
 - 5) Over voltage protection shall be provided and shall be calibrated as per manufacturer's instructions before power supply is put into use.

- 6) Transient response time at a change of 50 percent load shall be no more than 50 msec.
- 7) Overload protection shall be provided and consist of automatic current limit fold back.
- c. General equipment specifications shall be as follows:
 - 1) Operating temperature range shall be from 0 to 50 degree C with a derating of 40 percent at 70 degree C.
 - 2) Stability after warm-up shall be K5 percent.
 - 3) Power supplies shall not be provided with covers.
 - 4) For installations without 20 CFM forced air cooling, provided units must be derated by 30 percent (multiply required load by 143 percent).
2. Provide Sola Silver Line Series Catalog SLS, SLD and SLT power supplies or "approved equal" item.

S. Signal Conditioners

1. For 4-20 mA and 1-5 VDC analog instrument signals, when shown on the Contract Design Drawings, provide signal conditioners with specifications as listed below:
 - a. Signal conditioning functions shall be as listed below:
 - 1) Signal isolation.
 - 2) Signal conversion.
 - 3) Signal splitting.
 - 4) Protection of equipment and signals (area isolation).
 - 5) Amplify (boost) signals.
 - 6) Eliminate source and loop powered conflicts (bucking power supplies).
 - 7) Step down high voltage signals to safe levels.
 - 8) Provide isolation for non-isolated transmitters.
 - 9) Provide RF filtering options.
 - b. Modes of operation shall be:
 - 1) 2-wire, output-loop powered.
 - 2) 2-wire, input-loop powered.
 - 3) 4-wire, line powered at 117VAC, 230VAC and 24VDC (nominal).
 - c. Mounting shall be on 32 mm G-type and 35 mm top hat.
 - d. Housing shall be DIN aluminum.
 - e. Ambient temperature operating and storage ranges shall be from -40 degree F to +185 degree F.
 - f. Accuracy shall be as high as K0.075 percent of span.
 - g. Stability shall be K0.2 percent of reading per year.
 - h. Isolation values between input and output shall be as follows:
 - 1) Without RF option - 1500Vrms.
 - 2) With RF option - 500Vrms
 - i. Input and output over voltage and reverse polarity protection values shall be:

- 1) Output - - 48V maximum over voltage and 48V maximum reverse voltage.
- 2) Input - 250 percent of full scale for current inputs and 150 percent of full scale for DC voltage inputs.
- j. Ripple shall be 10mV peak-to-peak maximum measured across a 250 Ω resistor.
- k. Common mode rejection shall exceed 95dB at 60 Hz with a limit of 1500Vrms.
- l. Span and Zero adjustments shall be provided with front panel pots and shall have the following tolerances and capabilities:
 - 1) Span shall be K10 percent.
 - 2) Zero shall be K5 percent.
 - 3) Zero setting shall be non-interactive when span is set first.
2. Provide Moore Industries ECT-DIN Signal Isolators or "approved equal" item.

T. Signal Switching Relays

1. Relays used on nominal 24VAC or 24VDC control circuits, 50 mA and less.
2. Relays shall be plug-in (ice cube) pin type, general purpose with DIN rail mounted bases.
3. Number of poles shall not be less than three.
4. Indicating and test features:
 - a. Each relay shall have an indicating light/ LED to show when the relay coil is energized.
 - b. Each relay shall be provided with a manual test button that forces relay contacts to switch to an energized position.
5. Contacts shall be form C (switch over) bifurcated for low power applications and rated at a minimum of six amps at 250VAC and six amps at 30VDC.
6. Relay bases shall have coded rings, integrated clips (relay hold-downs) and built in marking labels.
7. Provide Relco C3 T31 3 pole relays with S3-S base or "approved equal" item.

U. Selector Switches

1. 2, 3 & 4-position operator selector switches shall comply with the following standard requirements. If Contract Drawings specify switches with other features, the drawings will prevail:
 - a. Operators shall be of round construction, 30.5mm diameter, standard knobs (no levers, cylinder locks, etc.) and with rotary operators.
 - b. Switch operation shall be to maintain the position turned to unless specified otherwise.
 - c. The number of contacts, switch positions and other details shall be as shown on contract drawings with a minimum of two N.O. and two N.C. contacts provided per switch.
 - d. Operators shall be rated as NEMA 4/13.

- e. Contacts shall be rated at 10 amps.
- f. For standard cam configurations, provide the following switches:
 - 1) For two position switches, provide Allen-Bradley Bulletin 800T-H2B or "approved equal" item.
 - 2) For 3 position switches, provide Allen-Bradley Bulletin 800T-J2B or "approved equal" item.
 - 3) For 4 position switches, provide Allen-Bradley Bulletin 800T-N2KF4B or "approved equal" item.

V. Pushbutton Switches

1. Push button operator switches shall be of round construction, 30.5mm diameter.
2. A minimum of two N.O. and two N.C. contacts provided per switch.
3. Reference the following table for operator construction and color required for intended use:

Function	Operator	Color
Motor (equipment) Start	Flush Head	Green
Motor (equipment) Stop	Extended Head	Red
Emergency Stop	Mushroom Head	Red
All Others	Flush Head	Black

4. Operators shall be rated as NEMA 4/13.
5. Contacts shall be rated at 10 amps.
6. Emergency Stop and other emergency switches shall be provided with a red mushroom head, N.C. contacts and shall be non-illuminated.
7. Provide the following switches:
 - a. For flush, green Start switches, provide Allen-Bradley Bulletin 800T-A1B or "approved equal" item.
 - b. For extended, red Stop switches, provide Allen-Bradley Bulletin 800T-B6B or "approved equal" item.
 - c. For Emergency switches, provide Allen-Bradley Bulletin 800T-D6B or "approved equal" item.
 - d. For all others, provide Allen-Bradley Bulletin 800T-A2B or "approved equal" item.

W. Indicator Lights

1. Indicating lights shall be of round construction, 30.5 mm diameter and shall have a built in push-to-test function.

2. Provide high visibility LED full voltage lamps for 120 VAC and 24 VDC circuits without the use of transformers with the exception of white 120 VAC lights as listed below.
3. Lens colors shall be as specified in the table listed below:

Function	Color
Motor (equipment) Running & Valves Closed	Green
Motor (equipment) Stopped & Valves Open	Red
Fault and Warning	Amber
Power On	White

4. Indicating lights shall be rated as NEMA 4/13.
5. Provide the following components:
 - a. For green, 120 VAC indicating lights, provide Allen-Bradley Bulletin 800T-QTH16G or "approved equal" item.
 - b. For green, 24 Volt AC or DC indicating lights, provide Allen-Bradley Bulletin 800T-QTH24G or "approved equal" item.
 - c. For red, 120 VAC indicating lights, provide Allen-Bradley Bulletin 800T-QTH16R or "approved equal" item.
 - d. For red, 24 Volt AC or DC indicating lights, provide Allen-Bradley Bulletin 800T-QTH24R or "approved equal" item.
 - e. For amber, 120 VAC indicating lights, provide Allen-Bradley Bulletin 800T-QTH16A or "approved equal" item.
 - f. For amber, 24 Volt AC or DC indicating lights, provide Allen-Bradley Bulletin 800T-QTH24A or "approved equal" item.
 - g. For white, 120 VAC indicating lights, provide Allen-Bradley Bulletin 800T-PTH16W or "approved equal" item.
 - h. For white, 24 Volt AC or DC indicating lights, provide Allen-Bradley Bulletin 800T-QTH24W or "approved equal" item.

X. Terminal Blocks

1. Terminal blocks shall be provided in all panels requiring field terminations.
2. Provide terminal blocks with the following color scheme:
 - a. Green/ Yellow - Ground terminations.
 - b. Black - All fused terminal blocks. Identify each block with voltage applied.
 - c. Red - Switched AC voltage terminal blocks (120 and 24VAC).
 - d. Blue - Switched and non-switched DC terminal blocks (12 and 24VDC).
 - e. Gray - AC hot power (normally energized).
 - f. Gray w/Orange switch button - Analog terminals with built-in isolation switch.

3. Connections shall be made as follows:
 - a. Wire terminations shall be at the rate of one wire per terminal connection.
 - b. When two wires or more are required to be connected on the same terminal on the same side, use two or more terminal blocks with bridge jumpers.
4. Din rail mounting:
 - a. Terminal blocks shall mount on deep type (> 7.5 mm/ .295 in.) DIN three rail only.
5. Terminal block jumpers shall comply with the following:
 - a. Terminal jumpers shall be of the manufacturer's bridge type connectors (connecting each terminal in the center).
 - b. Comb type jumpers and shop manufactured wire jumpers shall not be used.
 - c. Provide factory printed terminal block identifiers on both sides of each terminal. Terminal identifiers that attach in the middle of the terminal and hand written identifiers shall not be used.
6. Required terminal components:
 - a. Provide all required accessories that are needed to construct a complete terminal assembly including end stops, separators, terminal identifiers, etc.
 - b. All components used shall be from the same terminal manufacturer and shall comply with the requirements of that manufacturer to construct a complete terminal assembly.
7. Provide the following components:
 - a. Analog terminal blocks shall comply with the following:
 - 1) They shall be rated for a maximum of 15 amps and 500 VAC and to accept wires from 22 to 8 AWG for single conductors per termination.
 - 2) Analog terminal blocks shall have a disconnect switch and test plugs to allow circuit testing and connection of test meters without breaking the analog circuit.
 - 3) Provide Entrelec M 6/8 STP1 terminal blocks or "approved equal" item.
 - b. Low current terminal blocks shall comply with the following:
 - 1) They shall be UL rated for a maximum of 30 amps and 600 VAC and to accept wires from 22 to 10 AWG for single conductors per termination.
 - 2) Provide Entrelec M 4/6 terminal blocks with BAM 103 002.26 (gray) end stop or "approved equal" item.
 - c. Medium current terminal blocks shall comply with the following:
 - 1) They shall be UL rated up to 50 amps at 600 VAC and to accept wires from 22 to 8 AWG for single conductors per termination.
 - 2) Provide Entrelec M 6/8 terminal blocks with BAM 103 002.26 (gray) end stop or "approved equal" item.
 - d. High current terminal blocks shall comply with the following:
 - 1) They shall be UL rated up to 65 amps at 600 VAC and to accept wires from 20 to 6 AWG for single conductors per termination.
 - 2) Provide Entrelec M 10/10 terminal blocks with BAM 103 002.26 (gray) end stop or "approved equal" item.

Y. Hollow Shaft Terminations

1. Provide hollow shaft terminations on each terminated wire.
2. Hollow shaft terminations shall be provided with the manufacturer's approved crimping tool.
3. Provide terminations that use standard colors, are insulated and have the longest shaft manufactured for the provided type.
4. Provide Weidmuller Hollow Shaft Terminations (or "approved equal" item) with part numbers as required per the following table:

Nominal Wire Size (MM2)	AWG	Standard Color	Part Number
0.5	20	Orange	69070
1	18	Yellow	46300
1.5	16	Red	46310
2.5	14	Blue	901916
4	12	Gray	901919

2.02 ACCESSORIES

- A. Provide all necessary wire and cables contained within the control enclosures to properly power installed equipment included in the PLC system design.
- B. Provide the necessary programming interface cables and converters for uploading and downloading software to both the PLC, and OIT.

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. Pursuant to UL 508 - Requirements.

3.02 FIELD QUALITY CONTROL

- A. Verification of Performance
 1. All device functions shall be observed by PROJECT MANAGER to determine satisfactory operation of the device and connected circuit continuity before shipment. While observing operational tests, PROJECT MANAGER will also inspect the equipment for workmanship.

3.03 ADJUSTING

- A. Pursuant to Section 01750 - Starting and Adjusting.
- B. During site testing, each adjustable component shall be calibrated to actual system requirements as observed during system testing.
- C. Record all settings and adjustment values established during site testing and give to the BUYER for future reference and use.

—END OF SECTION—

SECTION 13490

MEASUREMENT AND CONTROL COMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. The section includes the requirements pertaining to the checkout, calibration, and testing of the instrumentation provided as part of this procurement.
- B. Related Sections
 - 1. Section 13420 - Instruments
 - 2. Section 13451 - Programmable Logic Controllers
- C. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures

1.02 SUBMITTALS

- A. Closeout Submittals
 - 1. Closeout Submittals should include the documentation and certification for all instruments and controls commissioned Pursuant to Section 01775 - Closeout Submittals and Procedures.

1.03 SCHEDULING

- A. The commissioning period shall begin when the PROJECT MANAGER has approved the performance test demonstration pursuant Section 01810 - Commissioning.

1.04 SYSTEM START UP, COMMISSIONING, AND OWNER'S TRAINING

- A. General
 - 1. SELLER shall provide required schedule of testing and sufficient notice to be able to include BUYER'S personnel required to begin system start-up, commissioning, and training pursuant to Section 01750 - Starting and Adjusting. The procurement schedule shall not be sufficient notice.
 - 2. SELLER shall provide technical assistance, equipment and materials necessary to implement all installation test and inspection activities specified herein.
- B. Checkout
 - 1. After all installation and connection work has been completed, SELLER shall check the equipment under his responsibility.

2. This shall include the following:
 - a. A check for overall correctness.
 - b. Verifying polarity of electric power and signal connections.
 - c. Verifying correct applied voltages to all equipment.
 - d. Verifying required grounds are properly connected.
 - e. Verifying the integrity of all connections and other similar pertinent details.
3. SELLER shall certify in writing each loop or system checked out has been verified for correctness and those discrepancies identified have been corrected. A copy of this certification shall be provided to the BUYER.
4. SELLER shall verify mounting stand and bracket materials and workmanship comply with requirements set forth in the Procurement Documents.

C. Calibration

1. Analog instrumentation and control system equipment shall be calibrated and tested following check out.
2. SELLER shall provide the BUYER's Contractor the necessary technical assistance, tools and equipment to calibrate each instrument in accordance with the manufacturer's specifications and instructions.
3. Analog instrument shall be calibrated at a minimum of five points using test equipment to simulate inputs and read outputs and this calibration shall be conducted while increasing the inputs and decreasing the inputs. These calibration points shall conform to analog values of 4, 8, 12, 16 and 20 mA (or 1, 2, 3, 4 and 5 VDC if appropriate).
4. Analog instruments shall be calibrated and tested in place without removal.
5. Test equipment and instruments used to simulate inputs and read outputs shall be suitable for the purpose intended and shall be calibrated related to accuracy greater than the required accuracy of the instrument being calibrated. Such test equipment shall have accuracy traceable to the National Bureau of Standards as applicable.
6. Test data shall be entered on certification forms provided by BUYER.
 - a. These certification forms shall verify compliance with applicable accuracy requirements, instrument manufacturer published performance specifications and permissible tolerances at each point of calibration.
 - b. A report shall be delivered to BUYER for each instrument, certifying the instrument has been calibrated and meets requirements of the contract documents.
 - c. The report shall include pertinent manufacturers name plate data, measurement units, span setting, any error in percent at each test point, switch and alarm set points, valve stroking and controller balancing information.

D. Analog Loop Tests

1. SELLER shall provide the BUYER's Contractor the necessary technical assistance, tools and equipment to field test, inspect and adjust each instrument installed under this contract to its specified performance requirement in accordance with manufacturer's specifications and instructions.

2. Instruments provided by SELLER which fail to meet any contract requirement or any published manufacturer performance specification for functional and operational parameters not specified in the contract, shall be repaired or replaced, at the discretion of PROJECT MANAGER at no cost to BUYER.
3. Each element of the analog loop shall be tested and exercised by the SELLER to demonstrate correct operation, first individually and then as a complete loop.
4. Each hardwired analog loop shall be tested to verify proper performance within specified accuracy tolerances.
5. Individual component accuracy requirements shall be as specified by contract requirements or by published manufacturer accuracy specifications.
6. Each analog loop shall be tested by applying simulated analog and/or discrete inputs to the first element of the loop, e.g., controllers, alarms, transmitters, etc. For loops that incorporate analog components, simulated sensor inputs corresponding to the five test points listed previously.
7. When installation tests have been successfully completed for all individual instruments and all separate analog control loops, certification forms prepared by BUYERS Contractor, shall be furnished to BUYER.

E. System Testing

1. The SELLER shall notify the BUYER a minimum of 14 days in advance of the scheduled system testing to allow time for the downloading of the DCS program.
2. System testing shall begin after acceptance of all wire, calibration and loop tests.
3. All systems shall be tested prior to the beginning of plant operational testing.
4. System testing shall follow detailed test procedures and check lists developed by the BUYER.
5. Test data shall be acquired using equipment as specified and recorded on certification forms prepared by BUYER.
6. Completion of system testing activities shall be documented by a certified report, including all test forms, with test data entered, and shall be furnished to BUYER.
7. The proper operation of all final control elements, control panels and instrumentation furnished under this contract shall be verified by tests conducted in accordance with the requirements specified herein.
8. System testing shall at a minimum demonstrate the following:
 - a. Each component of the system operates correctly with all other components of the system.
 - b. Analog control loops operate in a stable manner.
 - c. All interlocks perform correctly.
 - d. All control sequences perform correctly.
 - e. The complete system is reliable and consistent under all conditions of plant operation.
9. Where appropriate to indicate performance, system testing activities shall include the use of water to establish service conditions simulating normal final control element operating conditions in terms of applied process loads, operating ranges and environmental conditions.

10. Final control elements, control panels and supplementary equipment shall be tested under start up and steady state operating conditions to verify proper and stable control is achieved using all motor control center and local field mounted control circuits associated with each system.
11. All hardwired and software control circuit interlocks and alarms shall be operational.
12. The control of final control elements and supplementary equipment shall be tested using both manual and automatic (where provided) control circuits.
13. The stable steady state operation of final control elements running under the control of field mounted automatic analog controllers or software based controllers shall be assured by adjusting the controllers, as required, to eliminate oscillatory final control element operation.
14. SELLER shall submit to BUYER a copy of completed test reports as specified in this section.
 - a. The forms shall state the contract requirements have been met and shall include a complete listing of the measurement and control instrumentation system maintenance/repair activities conducted during the system testing.
 - b. Prior to the start of the process control test certification, BUYER shall provide in writing the acceptance of individual system test results.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ADJUSTING

- A. Procedures and documentation for equipment shall follow the requirements pursuant to Section 01750 - Starting and Adjusting.

—END OF SECTION—

SECTION 15220

MISCELLANEOUS PROCESS PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Plastic pipe
2. Plastic tubing

B. Payment Procedures

1. Pursuant to Section 01200 - Price and Payment Procedures

1.02 REFERENCES

A. American Society of Testing Materials (ASTM)

1. A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
2. D1330 - Standard Specification for Rubber Sheet Gaskets
3. D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
4. D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
5. D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
6. D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
7. D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
8. F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

B. American National Standards Institute/ American Society of Mechanical Engineers (ASNI/ASME)

1. B1.20.1 - Pipe Threads, General Purpose
2. B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
3. B18.2.1 - Square and Hex Bolts and Screws
4. B18.2.2 - Square and Hex Nuts
5. B18.22.1 - Plain Washers

1.03 SUBMITTALS

A. Goods Data

1. Pursuant to Section 01330 - Submittal Procedures
2. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 GOODS.
3. Name of manufacturer, type, and model for each pipe, hose, and fitting.
4. Construction materials
5. Pipe wall thickness
6. Finishes
7. Pressure and temperature rating
8. Flange gaskets
9. Expansion joints
10. PVC pipe and fittings

B. Shop Drawings

1. Provide complete piping layout drawings for each equipment package requiring piping systems as indicated in the detailed equipment specifications.

C. Closeout Submittals

1. Pursuant to Section 01775 - Closeout Submittals and Procedures

1.04 QUALITY ASSURANCE

A. Tolerances

1. The general dimension, such as face-to-face, face or end-to-end, face or end-to-center, and center-to-center shall be within 1/8-inch of design values.
2. The inclination of flange face from true not to exceed 3/64 inch per foot.
3. Rotation of flange bolt holes not to exceed 1/16 inch.

B. Qualifications

1. Use labor that has been qualified by training and experience to capably accomplish the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. Store systems utilizing plastic pipe, tubing, and fittings between 40 degrees F and 90 degrees F.
2. Protect plastic pipe from exposure to sunlight.

1.06 WARRANTY

A. Correction Period

1. Pursuant to Section 00700 - General Conditions

PART 2 GOODS

2.01 MATERIALS

A. (15220.J01) Schedule 80 PVC Pipe With Solvent Welded Joints

1. Pipe - ASTM D1785, Cell Classification 12454, bearing NSF seal
2. Fittings - ASTM D2467, Cell Classification 12454, bearing NSF seal
 - a. Provide flanges or unions where needed to facilitate disassembly of equipment or valves.
 - b. Join flanges or unions to the pipe by a solvent weld.
 - c. Threaded joints may be used instead of solvent welded joints in exposed interior locations for the purpose of facilitating assembly.
 - d. The use of threaded joints in this system shall be held to a minimum.

B. (15220.J02) Schedule 80 PVC Pipe With Threaded Joints

1. Pipe - ASTM D1785, Cell Classification 12454, bearing NSF seal
2. Fittings - ASTM D2464, Cell Classification 12454, bearing NSF seal

2.02 ACCESSORIES

A. PVC Pipe

1. Flanges - Diameter and drilling shall conform to ANSI/ASME B16.5, Class 150
2. Flange Bolts and Nuts - ASTM A307, Grade B, length such that, after installation, the bolts will project $\frac{1}{8}$ to $\frac{3}{8}$ -inch beyond outer face of the nut.
 - a. Stainless steel for chemical feed systems.
 - b. Galvanized steel for other systems.
3. Flat Washers - ANSI B18.22.1, plain
 - a. Stainless steel for chemical feed systems.
 - b. Galvanized steel for other systems.
4. Flange Gaskets - Full face, $\frac{1}{8}$ -inch thick, chemical-resistant elastomeric material suitable for the specified service
5. Expansion Joints - Edlon "Thermo-molded TFE," or Resistoflex "Style R6905" molded expansion joint, or "approved equal" items.

B. Installation Materials

1. Anti-Seize Thread Lubricant - Jet-Lube “Nikal,” John Crane “Thred Gard Nickel,” Never-Seez “Pure Nickel Special,” Permatex “Nickel Anti-Seize,” or "approved equal" items.
2. Teflon Thread Sealer - Paste type; Hercules “Real-tuff,” John Crane “JC-30,” Permatex “Thread Sealant with Teflon,” or "approved equal" items.
3. Teflon Thread Tape - Hercules “Tape Dope,” John Crane “Thred-Tape”
4. Solvent Cement, or "approved equal" items.
 - a. PVC Systems - ASTM D2564
5. Primer, PVC Systems - ASTM F656

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspection

1. Inspect piping components for damage and cleanliness before being installed.
2. Do not use material damaged or contaminated in handling on the job unless it is repaired and re-cleaned to the original requirements.

3.02 INSTALLATION

A. General

1. Install instruments and specialty items according to the manufacturer’s instructions and with sufficient clearance and access for ease of operation and maintenance.
2. Threaded Pipe Joints
 - a. Pipe threads to conform to ANSI/ASME B1.20.1, NPT, and be fully and cleanly cut with sharp dies.
 - b. Not more than three threads at each pipe connection to remain exposed after installation.
 - c. Ream ends of pipe after threading and before assembly to remove burrs.
 - d. Threaded joints in plastic piping to be made up with teflon thread tape applied to male threads.
3. Solvent Welded Pipe Joints
 - a. Use solvent welded connections only for PVC or CPVC pipe.
 - b. Joint preparation, cutting, and jointing procedures to comply with the pipe manufacturer’s recommendations and ASTM D2855.
 - c. Bevel or chamfer pipe ends to the dimensions recommended by the manufacturer.
 - d. Block or restrain newly assembled joints to prevent movement during the setting time recommended by the manufacturer.

- e. Do not perform pressure testing of solvent welded piping systems until the applicable curing time, as set forth in Table X2.1 of ASTM D2855, has elapsed.
- 4. Flanged Pipe Joints
 - a. Tighten flange bolts sufficiently to slightly compress the gasket and effect a seal, but do not torque less than the minimum value required by the gasket manufacturer.
 - b. Flange bolts shall not be so tight as to fracture or distort the flanges.
 - c. Install a plain washer under the head and nut of bolts connecting plastic pipe flanges.
 - d. Apply anti-seize thread lubricant to the threaded portion of stainless steel bolts during assembly.
 - e. Do not apply pipe sealants, thread compounds, or other coatings to flange gaskets unless recommended by the gasket manufacturer for the specified service and approved by PROJECT MANAGER.
 - f. Use flat-faced flanges when mating to Class 125 flanges.
 - g. Use full-face gaskets with flat-faced flanges and use ring gaskets with raised faced flanges.
- 5. Other Pipe Joints
 - a. Proprietary type joints to be made in accordance with the manufacturer's recommendations and to the satisfaction of PROJECT MANAGER.

B. Pipe

- 1. Install piping on equipment skids without springing or forcing the pipe in a manner which would induce stresses in the pipe, valves, or connecting equipment.
- 2. Support piping in conformance with the piping manufacturer's recommendations.
- 3. Connect piping to equipment by flanges or unions.
 - a. Support piping connecting to equipment by a pipe support and not by the equipment.
- 4. Provide a union within two feet of each threaded-end valve unless there are other connections which will permit easy removal of the valve.
 - a. Provide unions in piping adjacent to devices or equipment which may require removal in the future and where required by the drawings or the specifications.
- 5. Provide taps for pressure gauge connections on the suction and discharge of pumping units with a nipple and a ball type shutoff valve.
- 6. Drilling and tapping of pipe walls for installation of pressure gauges or switches not permitted.
- 7. Install piping on skids so that lines are readily accessible for cleaning.
- 8. Provide tees at regular intervals in chemical piping with extra openings plugged, to facilitate cleaning.

- a. Apply teflon thread tape or teflon thread sealer to the threads of the plugs so that they can be easily removed.
9. At each point where hose or reinforced plastic tubing is connected to rigid piping, provide a quick-disconnect coupling.
10. Provide adequate drains and vents with appropriate shut-off valves as required to fully drain all piping located on equipment skids.

C. Valves

1. Locate isolation valves provided with equipment and instruments in a manner which will allow ease of access and removal of the items to be isolated.

D. Piping Assembly

1. Use labor that has been qualified by training and experience to capably perform the specified activities required to accomplish the work in a satisfactory manner.

E. Cleaning

1. Ensure the interior of pipe, valves, and fittings is smooth, clean, and free of blisters, loose mill scale, sand, dirt, and other foreign matter when installed.
2. Before being placed in service, the interior of lines to be thoroughly cleaned, to the satisfaction of PROJECT MANAGER.

—END OF SECTION—

SECTION 15223

MISCELLANEOUS PROCESS VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous Ball Valves
 - 2. Check Valves
- B. Goods Installed But Not Supplied Under This Section
 - 1. Valve actuators
- C. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures

1.02 REFERENCES

- A. American Society of Testing Materials (ASTM)
 - 1. A105 - Standard Specification for Carbon Steel Forgings for Piping Applications
 - 2. A108 - Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
 - 3. A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 4. A216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
 - 5. A276 - Standard Specification for Stainless Steel Bars and Shapes
 - 6. A351 - Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts
 - 7. B148 - Standard Specification for Aluminum-Bronze Sand Castings
 - 8. B584 - Standard Specification for Copper Alloy Sand Castings for General Applications
- B. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - 1. B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
 - 2. B16.5 - Pipe Flanges and Flanged Fittings
 - 3. B16.34 - Valves - Flanged, Threaded, and Welding End

- C. Manufacturers Standardization Society of the Valve and Fittings Industry
 - 1. SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.03 SUBMITTALS

- A. Goods Data
 - 1. Pursuant to Section 01330 - Submittal Procedures
 - 2. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 GOODS.
 - 3. Name of manufacturer
 - 4. Type and model
 - 5. Country of origin of cast gray iron and ductile iron valve components
 - 6. Certified copies of physical and chemical test results for the materials of construction of valve components
 - 7. Pressure rating
 - 8. Temperature rating
 - 9. Flow characteristics
- B. Shop Drawings
 - 1. Drawing showing position of actuator and shaft for each type of valve.
- C. Closeout Submittals
 - 1. Pursuant to Section 01775 - Closeout Submittals and Procedures

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection
 - 1. Valves that are part of a skid mounted piece of equipment shall be adequately protected in accordance with the manufacturers instructions.
 - 2. Valves that are provided by the SELLER to be installed by the BUYER's Contractor shall be protected in accordance with the following:
 - a. Store valves in accordance with manufacturer's instructions.
 - b. Protect valves from damage and exposure to the elements.
 - c. Do not store valves on earth or grass surfaces.
 - d. Keep dry at all times.

1.05 WARRANTY

- A. Correction Period
 - 1. Pursuant to Section 00700 - General Conditions

PART 2 GOODS

2.01 MATERIALS

A. Miscellaneous Ball Valves

1. Ball Valve Type 1
 - a. Rating - 500 psi nonshock cold WOG
 - b. Code - MSS SP-110
 - c. Type - In-line, two piece, end entry, full port
 - d. Body/Bonnet - ASTM B584-C84400 bronze
 - e. Trim:
 - 1) Seat - Reinforced Teflon
 - 2) Ball - Brass, or chrome plated brass
 - 3) Stem - Brass or bronze
 - 4) Thrust Washer - Reinforced Teflon
 - 5) Stem Seal - Teflon or Viton
 - f. End Connection - Threaded
 - g. Temp. Limitations - -20 to 400°F
 - h. Valve Operator - Lever
 - i. Manufacturers - Conbraco Industries “Apollo 77-100 Series”; Powell “Fig 4210T” or “approved equal” items.
2. Ball Valve Type 10
 - a. Rating - 150 psig nonshock cold WOG
 - b. Type - In-line, true union, full port (Schedule 80)
 - c. Body/Bonnet - PVC or CPVC
 - d. Trim:
 - 1) Seat - Teflon
 - 2) Ball - PVC or CPVC
 - 3) Stem - PVC or CPVC
 - 4) Thrust Washer - Teflon
 - 5) Stem Seal - Viton O-ring or “approved equal” items.
 - 6) Body Seals - Viton O-ring or “approved equal” items.
 - e. End Connection - Socket
 - f. Temp. Limitations - 0 to 140°F
 - g. Valve Operator - Lever
 - h. Manufacturers - Hayward Plastic Goods “True Union Ball Valve”, Nibco “Chemtrol TU Series Tru-Bloc Ball Valve”, Spears Manufacturing Co. “True Union 2000 Standard Series 3600 Ball Valve”
3. Ball Valve Type 11
 - a. Rating - 150 psig nonshock cold WOG
 - b. Code - []
 - c. Type - In-line, true union, full port (Schedule 80)
 - d. Body/Bonnet - PVC or CPVC

- e. Trim:
 - 1) Seat - Teflon
 - 2) Ball - PVC or CPVC
 - 3) Stem - PVC or CPVC
 - 4) Thrust Washer - Teflon
 - 5) Stem Seal - Viton O-ring
 - 6) Body Seals - Viton O-ring
- f. End Connection - Flanged, ASME B16.5, Class 150, raised face
- g. Temp. Limitations - 0 to 140°F
- h. Valve Operator - Lever
- i. Manufacturers - Hayward Plastic Goods "True Union Ball Valve"; Nibco "Chemtrol TU Series Tru-Bloc Ball Valve"; Spears Manufacturing Co. "True Union 2000 Standard Series 3600 Ball Valve"

B. Check Valves

- 1. Check Valve Type 10 - 3 inch and smaller
 - a. Rating - 150 psig nonshock
 - b. Type - Ball check, true union
 - c. Body - PVC or CPVC, valve material shall match pipe material
 - d. Trim:
 - 1) Ball - PVC or CPVC
 - 2) Seat - Viton or EPDM
 - 3) Seals - Viton or EPDM
 - e. End Connection - Socket
 - f. Temp. Limitations - 0° to 140°F
 - g. Manufacturers - Hayward Plastics Goods "Ball Check Valve", Nibco "Chemtrol True Union Ball Check Valve", Sears Manufacturing Co. "True Union 2000 Industrial Series 4500 Ball Check Valves" or "approved equal" items.
- 2. Check Valve Type 11 - 3 inch and smaller
 - a. Rating - 150 psig
 - b. Type - Ball check, true union
 - c. Body/Bonnet - PVC or CPVC, valve material shall match pipe material
 - d. Trim:
 - 1) Ball - PVC or CPVC
 - 2) Seat - Viton or EPDM
 - 3) Seals - Viton or EPDM
 - e. End Connection - Flanged, ASME B16.5, Class 150, raised face
 - f. Temp. Limitations - 0° to 140°F
 - g. Manufacturers - Hayward Plastics Goods "Ball Check Valve", Nibco "Chemtrol True Union Ball Check Valve", Sears Manufacturing Co. "True Union 2000 Industrial Series 4500 Ball Check Valves" or "approved equal" items.

2.02 ACCESSORIES

A. Valve Actuators

1. Provide valve actuators as specified in Section 15233.
2. Provide manual actuated valves 6 inches and smaller with levers.
3. Design each actuator so that shaft seal leakage cannot enter the actuator housing.

2.03 FABRICATION

A. Fabrication Tolerances

1. Length Tolerance - Unless otherwise specified, the actual length of valves to be within plus or minus 1/16 inch of the specified or theoretical length.

2.04 FINISHES

A. Shop Priming, Shop Finishing

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspection

1. Inspect valves and accessories for damage and cleanliness before being utilized in the Work.
2. Do not use material damaged or contaminated in handling on the job unless it is repaired and re-cleaned to the original requirements.

3.02 INSTALLATION

A. General

1. Install valves on equipment skids with sufficient clearance for proper operation of external mechanisms, and with sufficient clearance to dismantle the valve for in-place maintenance.
 - a. Installation to be in accordance with the valve manufacturer's recommendations.
2. Unless otherwise indicated on the drawings, valves installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the finish floor to be installed with their operating stems vertical.
3. Valves installed in horizontal runs of piping having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the finish floor to be installed with their operating stems horizontal. If adjacent piping prohibits this, install the stems and

operating handwheel above the valve horizontal centerline as close to horizontal as possible.

4. Orient operating stems of valves installed in vertical runs of pipe to facilitate the most practicable operation, as reviewed by PROJECT MANAGER.
5. Check Valves
 - a. Ball Check Valves
 - 1) Install ball checks in accordance with the manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

- A. Site Tests, Inspection
 1. Leakage Tests
 - a. Ensure valves are free from leaks.

—END OF SECTION—

SECTION 15224

ECCENTRIC PLUG VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Eccentric plug valves.
- B. Goods Installed But Not Supplied Under This Section
 - 1. Valve actuators as specified in section 15236 - Manual Valve and Gate Actuators.
- C. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 2. A536 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 3. D2240 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- B. American Water Works Association (AWWA)
 - 1. C606 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 2. C550 - Protective Interior Coatings for Valves and Hydrants
 - 3. C504 - Protective Interior Coatings for Valves and Hydrants
 - 4. C111 - Protective Interior Coatings for Valves and Hydrants
- C. American Society of Mechanical Engineers (ASME)
 - 1. B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, 250

1.03 SUBMITTALS

- A. Goods Data:
 - 1. Pursuant to Section 01330 - Submittal Procedures
 - 2. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 GOODS.
 - 3. General catalog data showing the following:
 - a. Dimensions of each size valve
 - b. Seal materials
 - c. Materials of construction
 - d. Valve pressure rating
 - e. Manual operator
 - f. Valve port area
- B. Shop Drawings:
 - 1. Valve dimensions for valve with actuator and components.
 - 2. Drawings to indicate the position of the valve actuator and valve shaft.
 - 3. Indicate the country of origin of cast grey iron and ductile iron valve components.
- C. Quality Assurance/Control Submittals
 - a. Submit certified copies of reports covering proof-of-design testing of valves, as set forth in Section 5.2 of ANSI/AWWA C504, together with an affidavit of compliance as indicated in Section 6.3 of ANSI/AWWA C504, to the PROJECT MANAGER before the valves are shipped.
 - b. Submit certified copies of physical and chemical test results for the materials of construction of valve components.
- D. Closeout Submittals
 - 1. Pursuant to Section 01775 - Closeout Submittals and Procedures

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading:
 - 1. Pursuant to Section 01600 - Goods Requirements.
 - 2. Ship valves with actuators as a unit.
- B. Storage and Protection:
 - 1. Store in clean, dry environment.
 - 2. Maintain factory packaging.

1.05 WARRANTY

A. Correction Period

1. Pursuant to Section 00700 - General Conditions

PART 2 GOODS

2.01 MANUFACTURERS

A. Plug Valves:

1. DeZurik
2. Keystone
3. Milliken
4. Victaulic
5. Clay & Bailey "No. 2193"

2.02 MATERIALS

A. Provide eccentric plug valves constructed of materials as follows:

1. Body - ASTM A126, Cast iron, Class B; or ductile iron, ASTM A536, Grade 65-45-12.
2. Plug - ASTM A126, Cast iron, Class B.
3. Plug Facing - Neoprene or Buna-N, 70 Type A durometer hardness in accordance with ASTM D2240.
4. Body Sea - Welded nickel overlay.
5. Upper and Lower Trunnion Bearings - Sleeve type; stainless steel, bronze, or teflon fabric with stainless steel backing.
6. Upper Bearing - TFE or Delrin.
7. Stem Seal - V-type packing or U-cups, Buna-N or TFE.
8. Shop Coatings:
 - a. Asphalt Varnish - Fed Spec TT-C-494 or "approved equal" items.
 - b. Medium Consistency Coal Tar - Carboline "Bitumastic Super Service Black" or Tnemec "46-465 H. B. Tnemecol"
 - c. Epoxy:
 - 1) For Gas Service - Ameron "Amercoat 385 Epoxy", Carboline "890", Tnemec "Series 69 Hi-Build Epoxoline II", or Plasite "Plasguard 7122"
 - 2) For Liquid Service - Ameron "Amercoat 385 Epoxy", Carboline "890", or Tnemec "Series 69 Hi-Build Epoxoline II".
 - d. Universal Primer - Ameron "Amercoat 385 Epoxy", Carboline "Carboguard 888 Primer", or Tnemec "Series 27 S. T. Typoxy" or "approved equal" items.
 - e. Rust-Preventive Compound - Manufacturer Standard.

2.03 COMPONENTS

A. Valve Construction:

1. Valve Body - Rated for a working pressure of at least 150 psi
 - a. Valve Port Area - At least 80 percent of the cross section of the connecting piping for 20 inch and smaller valves and 70 percent for 24 inch and larger valves.
 - b. Valves to provide tight shutoff at the rated pressure from either direction.
 - c. Provide an adjustable closed position plug stop.
 - d. Plainly mark each valve body to indicate the seat end.
 - e. Actual length of 10 inch and smaller valves within plus or minus 1/16 inch of the theoretical length.
 - f. Actual length of 12 inch and larger valves within plus or minus 1/8 inch of the theoretical length.
 - g. Provide valve ends compatible with connecting piping.
 - 1) Provide flanged, grooved, or mechanical joint ends as indicated on drawings.
 - 2) Provide flange diameter and drilling in conformance to ANSI B16.1, Class 125.
 - 3) Provide flat faced flanges and finish to true plane surfaces within a tolerance limit of 0.005 inch.
 - 4) Ensure the finished face is normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.002 inch per foot of flange diameter.
 - 5) Grooved End Dimensions - AWWA C606, Table 5, for rigid joints
 - 6) When grooved end valves are to be installed in flanged piping, provide two flange adapters compatible with the connecting piping with each valve.
 - 7) Mechanical Joint Ends - ANSI/AWWA C111/A21.11
2. Plug - One-piece construction with a cylindrical or spherical seating surface eccentrically offset from the center of the plug shaft
 - a. The interference between the plug face and the body seat, with the plug in the closed position, to be externally adjustable in the field with the valve in the line under pressure.
 - b. Plug surfaces to be faced with a resilient material as specified.
3. Seats - Cast in the body with raised, welded-in nickel overlay not less than 0.050 inch thick on surfaces in contact with the plug face
 - a. Overlay to be at least 90 percent nickel with a Brinell hardness of 200 or greater.
4. Stem Seals - Sealed by U-cups or by at least four self-adjusting chevron type packing rings.

B. Valve Actuators:

1. As specified in Section 15236 - Manual Valve Actuators, and as indicated in the following equipment specifications:
 - a. Section 11511 - High Rate Clarification (Actiflo®) System.
 - b. Section 11512 - High Rate Clarification (DensaDeg ®) System.
2. Actuators to be provided by valve manufacturer as a unit.

2.04 FINISHES

A. Shop Priming, Shop Finishing

1. Paint the following surfaces:
 - a. Unfinished Surfaces:
 - 1) Interior Surfaces:
 - (a) For Liquid Service - Epoxy
 - (b) For Gas Service - Epoxy
 - 2) Exterior Surfaces of valves to be buried, submerged, or installed in manholes or valve vaults - Medium consistency coal tar
 - 3) Exterior Surfaces of Other Valves - Rust-inhibitive primer
 - b. Polished or Machined Surfaces: Rust-preventive compound
 - c. Actuators and Accessories - Rust-inhibitive primer
2. Shop paint interior and exterior ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valves and accessories for corrosion protection.
 - a. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with specified field painting.
3. Interior epoxy coatings - AWWA C550, free of holidays.
 - a. Provide the total dry film thickness of shop-applied coatings not less than:

1) Medium Consistency Coal Tar	6 mils, minimum
2) Epoxy	10 mils, minimum
3) Rust-Inhibitive Primer	3 mils, minimum

2.05 SOURCE QUALITY CONTROL

A. Tests, Inspections:

1. Except as modified herein ,test eccentric plug valves in accordance with Section 5 of ANSI/AWWA titled "Rubber-Seated Butterfly Valves".
2. Performance test each valve in accordance with Section 5.2 and give a leakage test and a hydrostatic test as described in Sections 5.2.2 and 5.2.3.
3. Apply the leakage test to the seating face of the plug (tending to unseat the plug) at the rated pressure of the valve.

4. Ensure each valve is leak tight in both directions when closed by the actuator with the maximum differential pressure applied to the plug as specified in the Plug Valve Schedule.

PART 3 EXECUTION

3.01 INSTALLATION

A. Valves

1. Valves will be installed by a BUYER's Contractor under a separate agreement.

—END OF SECTION—

SECTION 15236

MANUAL VALVE ACTUATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Manual valve and gate actuators as required in the following equipment specifications
- B. Payment Procedures
 - 1. Pursuant to Section 01200 - Price and Payment Procedures

1.02 REFERENCES

- A. American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - 1. C500 -Metal-Seated Gate Valves for Water Supply Service
 - 2. C504 - Rubber-Sealed Butterfly Valves
 - 3. C507 - Ball Valves 6 inches through 48 inches
 - 4. C560 - Cast Iron Slide Gates

1.03 SYSTEM DESCRIPTION

- A. Design Requirements, Performance Requirements
 - 1. Design actuators and appurtenances for the conditions and requirements indicated in the valve and gate schedules.
 - 2. Design actuators so that the working stresses do not exceed 1/3 of the yield point or 1/5 of the ultimate strength of each material.
 - 3. When valves are to be buried, submerged, or installed in vaults, seal the actuator and accessories to prevent entrance of water.
 - 4. Design water depth is as indicated in the valve schedules, but not less than 20 feet.
 - 5. Size gate actuators to produce the torque or thrust required to operate the gate when subjected to seating and unseating operating heads indicated in the gate schedule.
 - 6. Measure design and operating head from the surface of the water to the centerline of the gate.

1.04 SUBMITTALS

A. Goods Data

1. Pursuant to Section 01330 - Submittal Procedures
2. Manufacturer's Data including materials of construction, equipment weight, and related information for each item specified in PART 2 GOODS.
3. General catalog data showing the following:
 - a. Dimensions of each size actuator
 - b. Materials of construction
 - c. Torque output rating
 - d. Corrosion resistance
4. Indicate the country of origin of actuator and its components.

B. Shop Drawings

1. Actuator dimensions and weight
2. Mounting position of actuator on valve or gate

C. Quality Assurance/Control Submittals

1. Certificates
 - a. Certified copies of physical and chemical test results for the materials of construction.

D. Closeout Submittals

1. Pursuant to Section 01775 - Closeout Submittals and Procedures

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

1. Pursuant to Section 01600 - Goods Requirements

B. Storage and Protection

1. Actuators will be shipped with valves and should be stored as units.
2. Store in a clean, dry environment.
3. Maintain factory packaging.

1.06 WARRANTY

A. Correction Period

1. Pursuant to Section 00700 - General Conditions

PART 2 GOODS

2.01 MATERIALS

- ##### A. Conform to requirements of ANSI/AWWA C504 and C540.

B. Manual Valve Actuators:

1. General:
 - a. Provide manual actuators for all valves provided.
 - b. Provide handwheel with each geared actuator.
 - c. Rotation of handwheel, wrench nut, or lever to be counter-clockwise to open.
 - d. Handwheels to have the word "open" and an arrow indicating direction to open cast thereon.
 - e. Provide removable cover over housing of traveling-nut type actuators.
 - 1) Provide internal open and closed travel limiting devices.
 - 2) Provide removable roll pin, cotter pin, or other positive locking device on travel limiting lock nuts or collars.
 - 3) Clamps or setscrews are not acceptable.
 - f. Design so that shaft seal leakage cannot enter actuator housing.
 - g. Provide an infinitely variable locking device or a totally enclosed gear actuator for valves in throttling service.
 - h. Maximum pull on handwheel, chain, or lever of 80 lbs.
 - i. Actuator to withstand, without damage, a pull of 200 lbs on handwheel or chainwheel, or 300 ft-lbs on operating nut.
2. Handwheels. Handwheel diameters to be as follows:
 - a. Minimum 8 inches but not more than 24 inches for 30 inch and smaller valves.
 - b. 30 inches for 36 inch and larger valves.
3. Chainwheels Provide valves with center lines more than 7'-6" above the floor with chainwheels and operating chains.
 - a. Provide each chainwheel operated valve with a chain guide to permit rapid handling of the operating chain without "gagging" of the wheel.
 - b. Provide suitable extension if necessary, to prevent interference of the chain with adjacent piping or equipment.
 - c. Provide hot-dip galvanized or zinc plated carbon steel operating chains looped to extend to within 4 feet of the floor below the valve.
4. Levers
 - a. Provide levers capable of being locked in at least five intermediate positions between fully open and fully closed.
 - b. For buildings or structures containing lever operated valves, provide at least two operating levers for each size and type of lever operated valve.
5. Chain Levers:
 - a. Provide suitable actuator extensions if necessary, to prevent interference of the chain with adjacent piping or equipment.
 - b. Provide hot-dip galvanized carbon steel operating chains looped to extend to within 4 feet of the floor below the valve.

2.02 ACCESSORIES

A. Position Indicators:

1. Provide each valve actuator with a position indicator to display the position of the plug or disc relative to the body seat opening.
2. Mount position indicators for quarter turn plug or ball valves installed in interior locations on the outer end of the valve operating shaft extension.
3. Provide a suitable stuffing box or other seal where the shaft passes through the cover to prevent the entrance of water.
4. Mount valve disc position indicator on the end of the valve shaft for butterfly valves, except where located in manholes, buried, or submerged.
5. Provide a disc position indicator on each operating stand or the actuator mounted thereon.

2.03 FINISHES

A. Shop Priming, Shop Finishing - Shop coat ferrous metal surfaces, except bearing and finished surfaces for corrosion protection provided functionally equivalent to specified coating and compatible with the specified field painting.

1. Actuators to be provided with manufacturer's standard finish.
2. Surfaces to be finished:
 - a. Polished or machined surfaces - Rust prevention compound
 - b. Other surfaces - Epoxy enamel
 - c. Actuators and accessories - Universal primer

PART 3 EXECUTION

3.01 INSTALLATION

A. Actuator Installation

1. Actuators to be attached to valves as required in valve sections.

3.02 RE-INSTALLATION

- A. Whenever an actuator must be removed to permit installation of valve or gate, promptly reinstall actuator.
- B. Prior to placing in service, submit a written report from the manufacturer's representative to the PROJECT MANAGER certifying that the valve and actuator have been inspected and adjusted and are suitable for the service conditions.

3.03 PROTECTION

- A. Protect actuators from damage during transportation, as required.

—END OF SECTION—